**Annex 1**


**Project „Water bodies without borders" (EstLat 66)**

# *EstModel* modelling for nutrient load calculation at transboundary waterbodies

Main principles of modelling, pressures information involved, results of modelling, results comparison with environmental standard in EE and LV, recommendation regarding to action plan (where does the pressure come from, is it natural or man-made), figures which illustrate the origin of N and P pressure about waterbodies in not good status.



February 2020

# *EstModel* background

*EstModel* is a model for the assessment of the runoff of plant nutrients (phosphorus, nitrogen) from a catchment that is customised with monitoring data. The idea and the calculating logarithms were created by Peeter Ennet (Estonian Environment Agency) and Eero Pihelgas (Estonian Environmental Research Centre).

The model consists of calculation of the loads of N and P; thereat, the load on the catchment, the load on the waterbody, and the load carried out of the area included in the calculation are differentiated. Decreases in the load arising from retention are taken into consideration in calculating the loads.

Compared to the complicated models which describe the runoff processes from catchments in detail, such as SWAT (*Neitsch, S.L. et al.,2011*), HYPE (*Lindstrom, G. et al., 2010*), or the Qual2 stationary river water quality model (*Pelletier, G. and Chapra, S., 2008*), *EstModel* requires a significantly smaller amount of data and has a higher level of generalisation. One of the most time-consuming and work-extensive issues involved in using models is the existence of and access to the source data. Compared to large-scale models, using *EstModel* is considerably easier to use, as the model adjusts automatically to the area included in the calculation and is reset automatically. Thus, the model does not call for the work-extensive and time-consuming collection of source data and preparation by the user.

One of the prerequisites of creating the calculation logarithms of *EstModel* was that all the source data required should be available from national databases by automatic inquiries (Figure 1).

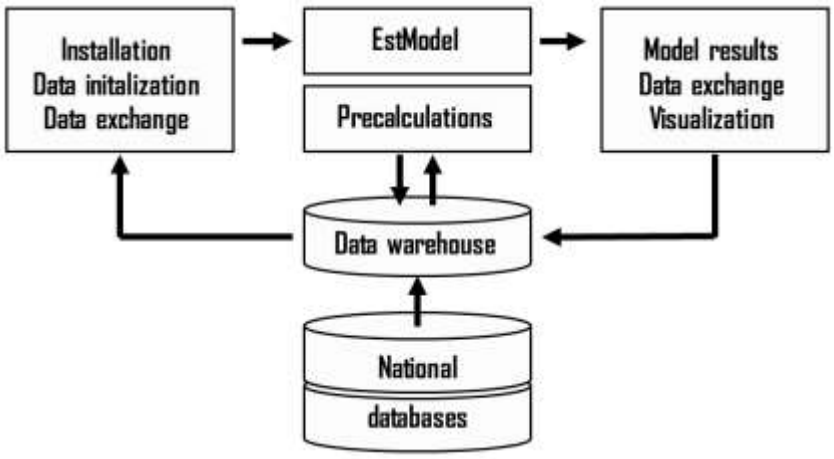


***Figure 1.*** *Estmodel scheme.*

Several assumptions, simplifications, and original calculation algorithms were used in preparing *EstModel*. The characteristics of *EstModel* include:

- full adjustment of the results achieved by the model with monitoring data;
- calculations based on subcatchments;
- calculations based on land cover class;
- differentiation of natural and man-made loads;
- calculation of the measures to alleviate the man-made load;
- enabling the use of the user's calculation versions;
- enabling selection of a random calculated area;
- automatic installation in a randomly selected area;
- automatic resetting based on national monitoring data;

The primary assumptions and simplifications are:

- stationarity (constant calculation conditions in the area);
- homogeneity (similarity of the calculation parameters of the subcatchment).

The temporal and spatial scale of the calculations of *EstModel* enables to estimate the runoff of nutrients from a catchment in the temporal and spatial dimensions characteristic to the specific catchment. Figure 2 demonstrates the temporal and spatial dimensions characteristic to the source data and calculations of *EstModel*.

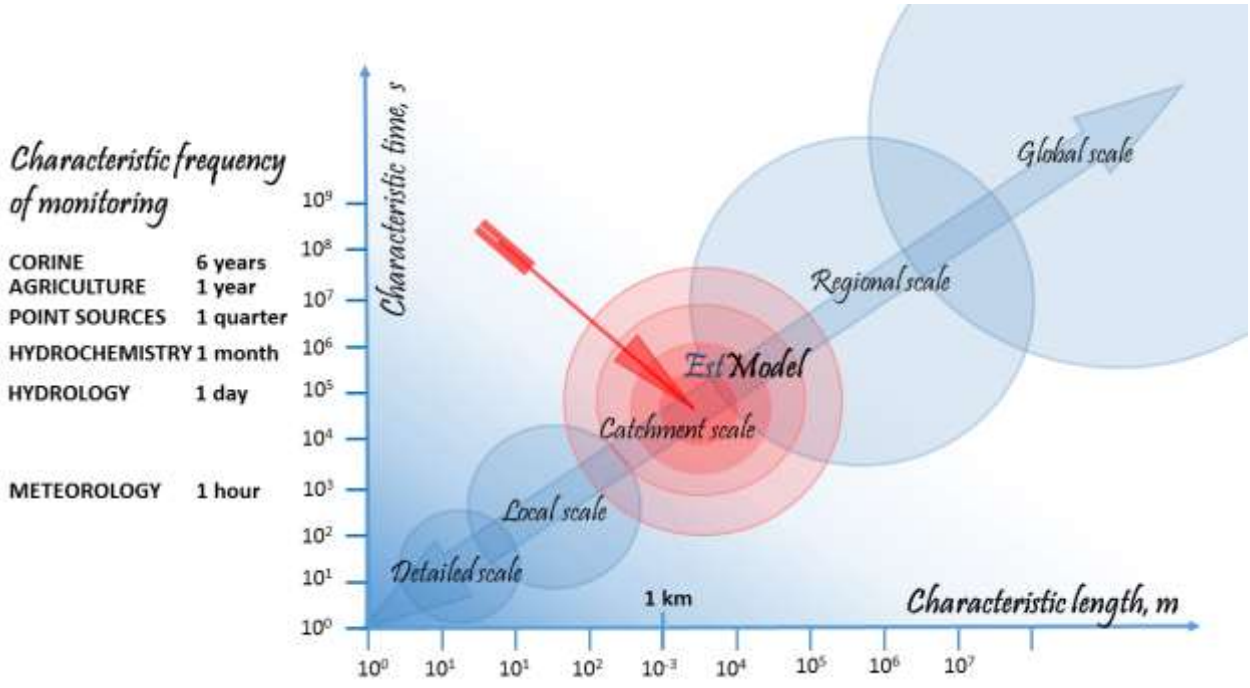


***Figure 2.*** *The temporal and spatial dimensions characteristic to the estimations of EstModel.*

The reference spatial units used for calculations in *EstModel* include sub-basins, subcatchments, and the surface areas of the CORINE land cover classes in the subcatchments.

The model is customised with the monitoring data separately in each sub-area of the calculations of the model.

*EstModel* enables to calculate runoff of nutrients from any randomly selected calculated area.

The intermediate catchments are used as units of calculation in the model. A intermediate catchment is a section of the catchment of a hydrochemical monitoring station that does not include the catchments of other hydrochemical monitoring stations in the catchment thereof. All calculation areas are divided into monitored and unmonitored areas.

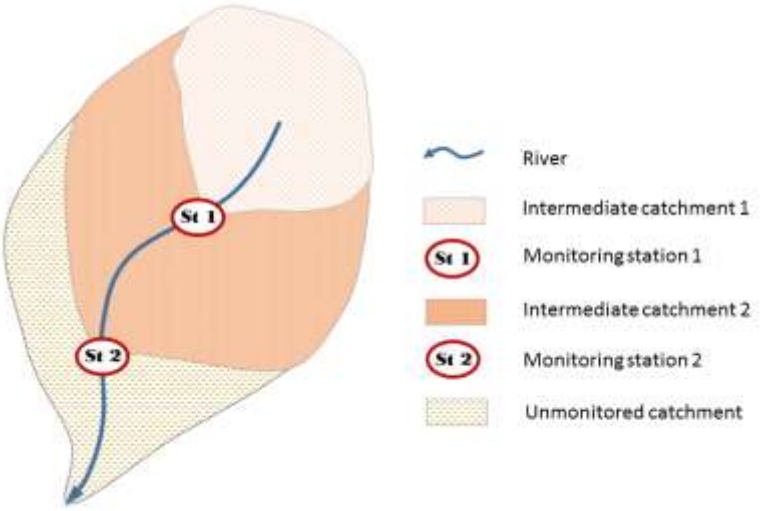


***Figure 3**. Division of the catchment of a river into intermediate catchments*

Figure 3 is a schematic drawing of a river with two monitoring stations. In the drawing, the first subcatchment is the entire catchment of monitoring station 1 and the other subcatchment is the part of the catchment of monitoring station 2 minus the catchment of monitoring station 1.

As the intermediate catchments are determined every year based on monitoring data, the number of intermediate catchments in an area and the contours thereof may differ by years based on whether or not there is monitoring data available.

The smallest calculation units based on surface area in the *EstModel* assessments are the surface areas of the CORINE land cover classes in a subcatchment or a sub-area of a subcatchment. The land cover classes used in the model include arable land, forest, pastureland, peat bog, wetland, waters, and other areas. The model calculates runoff of nutrients separately from each

land cover class of a calculated area and from point sources. The model distinguishes natural and man-made load (see Figure 4).

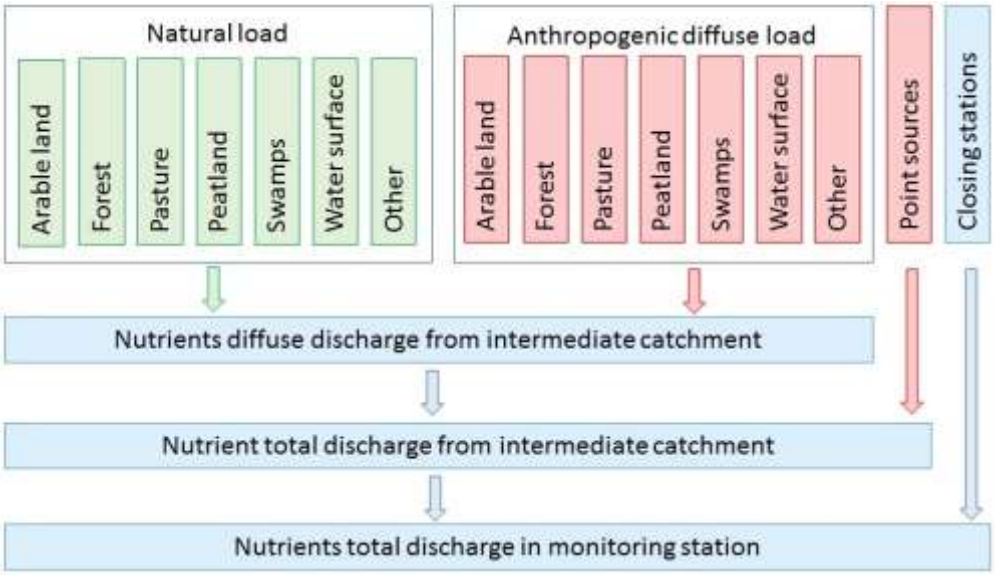


***Figure 4****. The calculation elements of EstModel's load estimations.*

Runoff from a catchment is divided into natural runoff and man-made load based on the origin of the source of the load. Based on the type of the source of the load, runoff is divided into diffused load and point source load. The diffused load of a catchment includes natural runoff and man-made load; point source load, however, is man-made load. The load of each reference sub-area is the total of the diffused load and point source load of the calculated area.

Temporally, *EstModel* has been applied to calculate average annual values. Any period of time in years may be used for the calculation; thereat, the model is adjusted with monitoring data in each year of calculation and separately for each intermediate catchments.

Input data are found for each subcatchment to perform the calculations. The runoff from the subcatchments, which is an input for the model, is calculated based on hydrological monitoring data. The remaining input data are found by making queries to national databases and geoinquiries of different contours (subcatchment, reference sub-area, etc.). If no data is available, assumed default values stored in the administration interface are used in the case of some data.

Using the model and the calculation process consists of the following main steps:

- selection of the total reference area (the area selected for the calculation by the user);
- identification of the subcatchments in the reference total area;
- identification of the reference sub-areas;
- resetting of the model in the reference sub-areas;
- determining of the retention factors of the subcatchments;
- determining of the adjustment factors of the subcatchments;

- model calculations for each reference sub-area;
- visualisation and saving of the results.

# Model results and discussion

Nutrient runoff was calculated from the catchment area of 29 waterbodies in the Koiva River Basin. The calculations are based on 2017 data. Due to the large number of model results and the limited size of the report, it is not possible to analyze all of these modeled indicators. The detailed summary output for the all *EstModel* calculations is provided in an excel file (appendix 1). Model results are explained using figures, tables, brief comments and conclusions. The model results are illustrated by 9 figures:

Figure 5. N,P status classes of waterbodies in the Koiva river basin.

Figure 6. N – concentration dependence on anthropogenic load.

Figure 7. P – concentration dependence on anthropogenic load.

Figure 8. P – concentration dependence on N concentration.

Figure 9. P – concentration dependence on specific runoff.

Figure 10. Dependence of retention on catchment area.

Figure 11. N/P ratios.

Figure 12. Distribution of anthropogenic and natural N load in waterbodies.

Figure 13. Distribution of anthropogenic and natural P load in waterbodies.

There are 15 tables that explain the results:

Table 1. General data of calculated river waterbodies

Table 2. N diffused anthropogenic discharge of calculated river waterbodies

Table 3. N atmospheric discharge of calculated river waterbodies

Table 4. N natural discharge of calculated river waterbodies

Table 5. N diffused discharge (ant. + atm. + nat.) of calculated river waterbodies

Table 6. N diff. concentrations (ant. + atm. + nat.) of calculated river waterbodies

Table 7. N diff. specific load (ant. + atm. + nat.) of calculated river waterbodies

Table 8. P diffused anthropogenic discharge of calculated river waterbodies

Table 9. P atmospheric discharge of calculated river waterbodies

Table 10. P natural discharge of calculated river waterbodies

Table 11. P diffused discharge (ant. + atm. + nat.)) of calculated river waterbodies

Table 12. P diff. concentrations (ant. + atm. + nat.) of calculated river waterbodies

Table 13. Comparison of N concentrations with standards in EE and LV

Table 14. P diff. specific load (ant. + atm. + nat.) of calculated river waterbodies

Table 15. Comparison of P concentrations with standards in EE and LV

Table 16. Potential actionable diffuse source loads for nitrogen

Table 17. Potential actionable diffuse source loads for phosphorus

All model results and data derived from model results are presented as an excel file in the appendix. There are five worksheets in this file:

1) "Load" - in this worksheet the results are presented as loads (kg/a) from the catchment area;
2) "Concentration" - the results are presented as concentrations (mg/l);
3) "Specific load" - the results are presented as specific loads (kg/a/km$^2$);
4) "Source load" - the results are presented as source loads (kg/a);
5) "Opportunity" - the load volumes to be reduced in order to achieve the objectives.

Below, the model results are presented in a generalized form, attempting to represent all calculated areas together. The aim of water management plans is to achieve good status for all waterbodies. Based on modelled N concentrations 27 waterbodies in the Koiva river basin district were in the good and high status class and only 2 waterbodies were in the moderate status class. Based on P concentrations 12 waterbodies in the Koiva river basin district were 12 waterbodies were in the high status class, 5 in the good, 7 in the moderate, 4 in the poor and 1 waterbody was in the bad status class. In Figure 5 the aggregated overview in the Koiva river basin district is presented as a percentage of status classes.

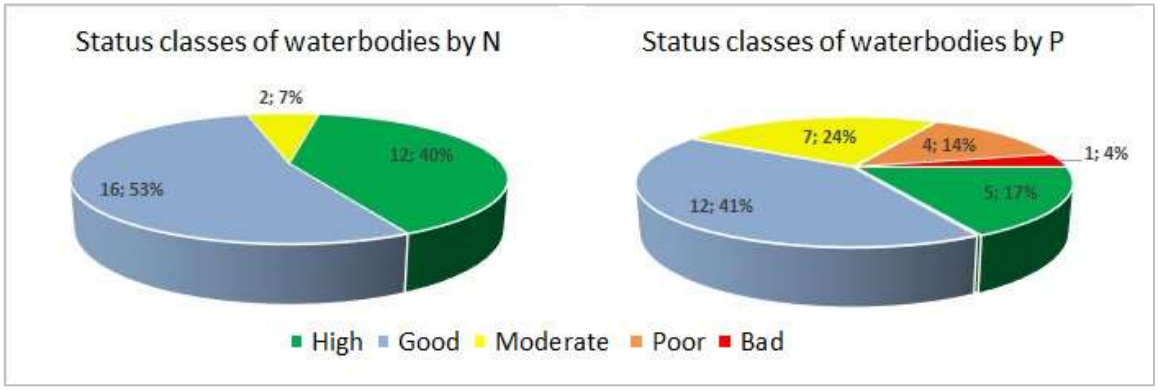


***Figure 5.*** *N,P status classes of waterbodies in the Koiva river basin.*

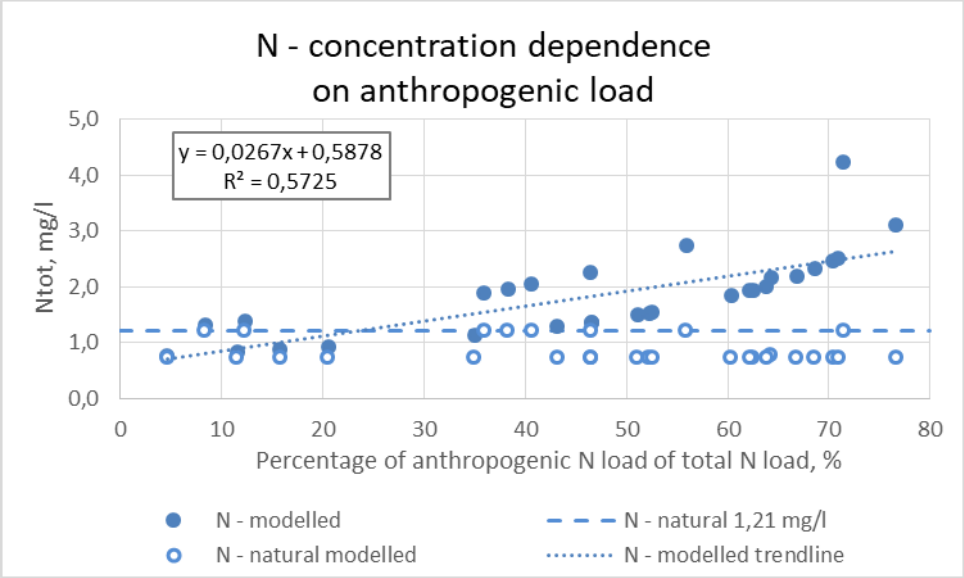


***Figure 6.*** *N – concentration dependence on anthropogenic load.*

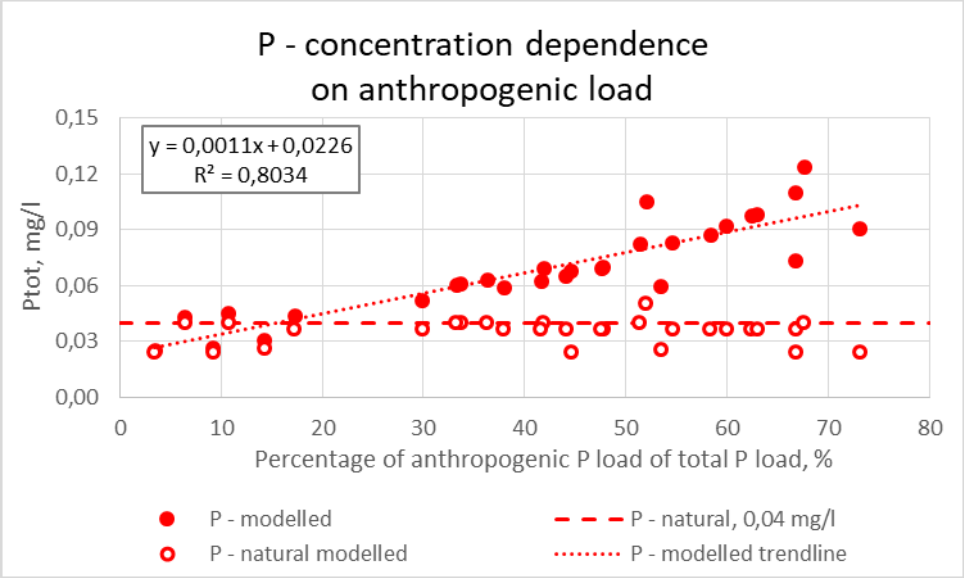


***Figure 7.*** *P – concentration dependence on anthropogenic load.*

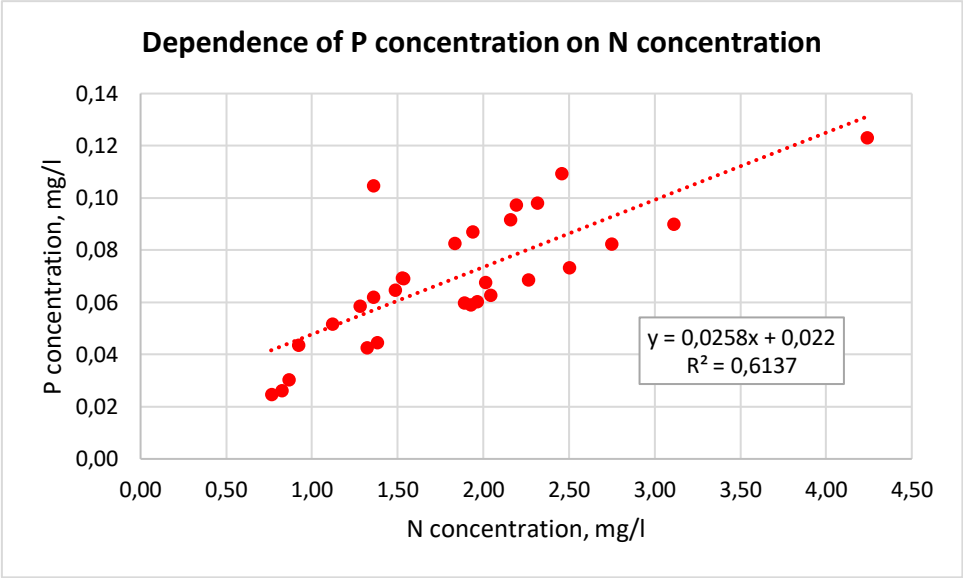


***Figure 8.*** *P – concentration dependence on N concentration.*

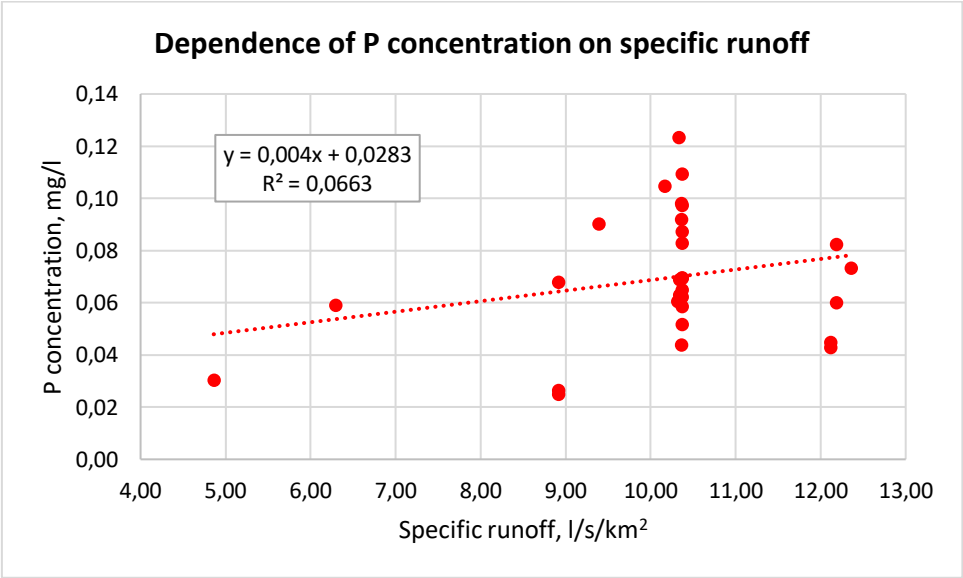


***Figure 9.*** *P – concentration dependence on specific runoff.*

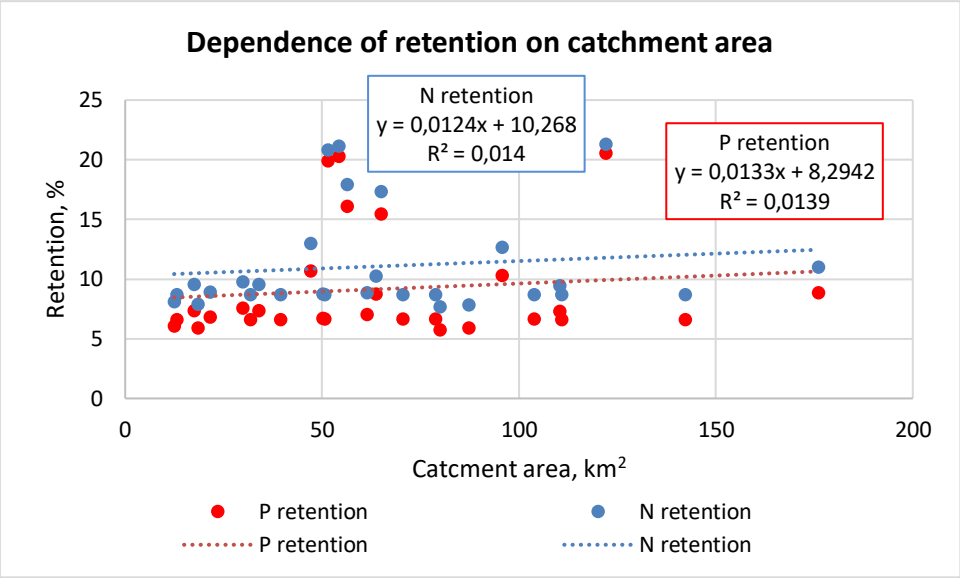


***Figure 10.*** *Dependence of retention on catchment area.*

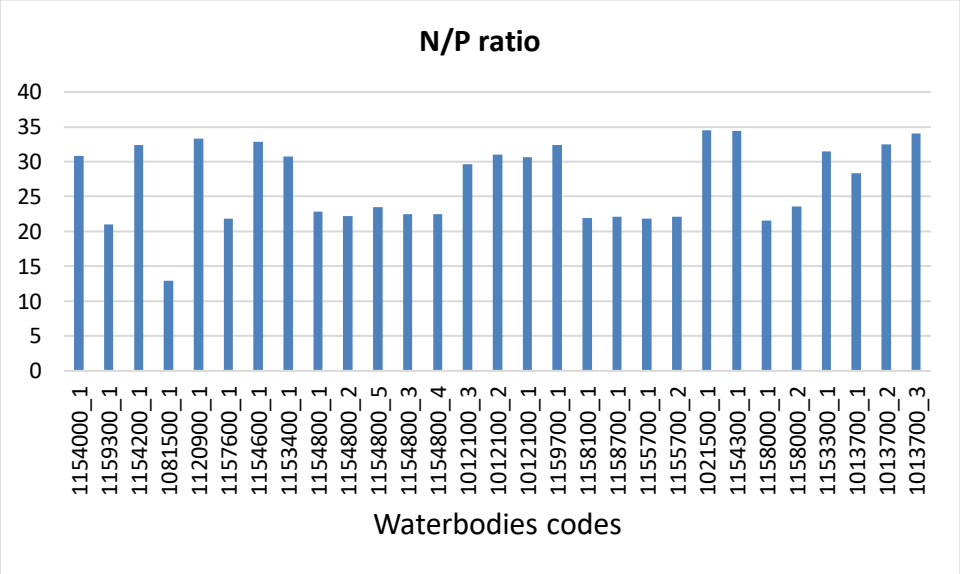


***Figure 11.*** *N/P ratios.*

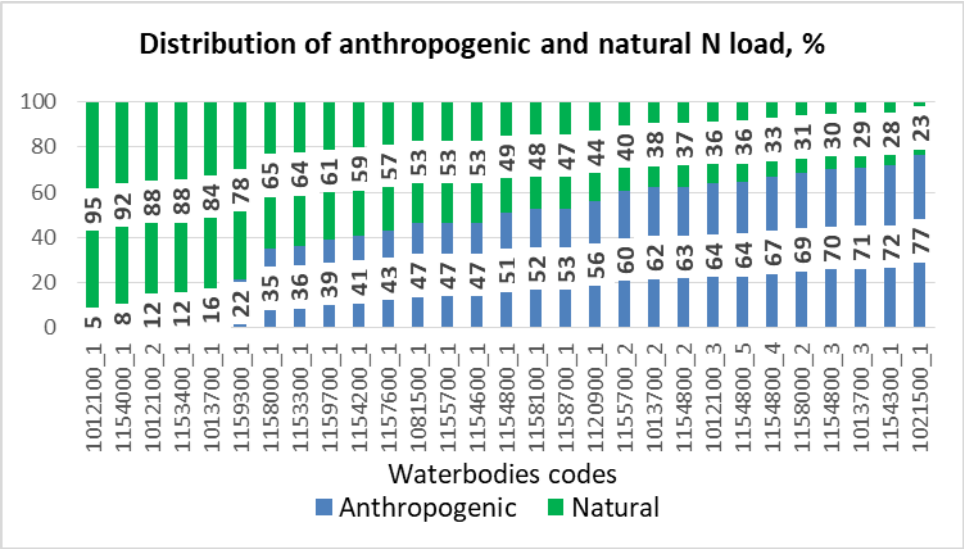


***Figure 12.*** *Distribution of anthropogenic and natural N load in waterbodies.*

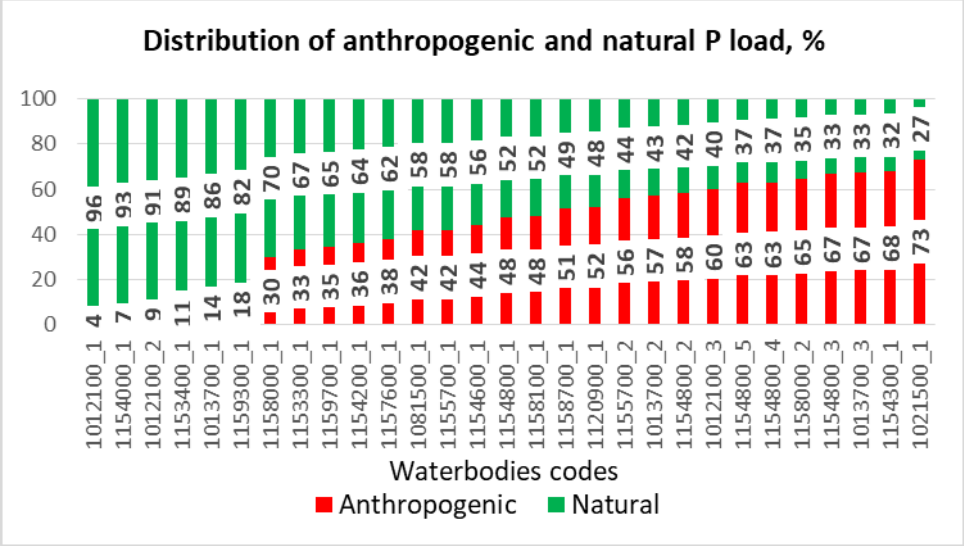


***Figure 13.*** *Distribution of anthropogenic and natural P load in waterbodies.*

***Table 1.*** *General data of calculated river waterbodies*

| | **Object** | | **Runoff** | | **Areas by land use, km$^2$** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | m$^3$/s | l/s/km$^2$ | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* |
| *1* | Atse_1 | 1154000_1 | 0,22 | 12,12 | 0,27 | 17,34 | 0,78 | 0,00 | 0,00 | 0,00 | 0,00 | **18,39** |
| *2* | Hargla_1 | 1159300_1 | 0,56 | 10,36 | 2,00 | 48,17 | 1,72 | 0,48 | 0,48 | 0,39 | 0,89 | **54,13** |
| *3* | Koiva_1 | 1154200_1 | 0,52 | 10,33 | 4,65 | 39,65 | 4,55 | 0,00 | 0,00 | 0,00 | 1,76 | **50,61** |
| *4* | Kolga (1)_1 | 1081500_1 | 0,51 | 10,16 | 5,78 | 37,48 | 2,97 | 0,66 | 0,66 | 0,00 | 2,58 | **50,13** |
| *5* | Kolga (2)_1 | 1120900_1 | 1,06 | 12,18 | 14,75 | 64,96 | 7,51 | 0,00 | 0,00 | 0,00 | 0,00 | **87,22** |
| *6* | Kuura_1 | 1157600_1 | 0,73 | 10,37 | 7,53 | 50,81 | 1,76 | 0,26 | 0,00 | 0,00 | 10,12 | **70,48** |
| *7* | Laanemetsa_1 | 1154600_1 | 0,67 | 10,33 | 7,58 | 47,47 | 5,82 | 0,00 | 0,97 | 0,11 | 3,02 | **64,97** |
| *8* | Lilli_1 | 1153400_1 | 0,36 | 12,11 | 0,61 | 27,16 | 0,95 | 0,49 | 0,21 | 0,01 | 0,31 | **29,74** |
| *9* | Mustjõgi_1 | 1154800_1 | 0,33 | 10,36 | 5,26 | 19,49 | 0,28 | 0,00 | 0,00 | 0,00 | 6,76 | **31,79** |
| *10* | Mustjõgi_2 | 1154800_2 | 1,47 | 10,37 | 30,88 | 90,41 | 9,16 | 0,25 | 0,00 | 0,00 | 11,37 | **142,07** |
| *11* | Mustjõgi_3 | 1154800_3 | 1,15 | 10,37 | 33,95 | 55,71 | 6,23 | 0,00 | 0,97 | 0,00 | 13,94 | **103,78** |
| *12* | Mustjõgi_4 | 1154800_4 | 0,82 | 10,37 | 21,00 | 44,08 | 1,14 | 0,29 | 2,21 | 0,00 | 9,95 | **110,80** |
| *13* | Mustjõgi_5 | 1154800_5 | 1,08 | 10,36 | 25,41 | 63,15 | 7,28 | 0,19 | 0,19 | 0,00 | 7,56 | **78,67** |
| *14* | Pedeli_1 | 1012100_1 | 0,16 | 8,91 | 0,14 | 17,26 | 0,00 | 0,00 | 0,00 | 0,00 | 0,06 | **63,65** |
| *15* | Pedeli_2 | 1012100_2 | 0,30 | 8,91 | 0,68 | 25,61 | 0,57 | 0,00 | 0,00 | 0,00 | 6,90 | **33,76** |
| *16* | Pedeli_3 | 1012100_3 | 0,57 | 8,91 | 12,82 | 38,36 | 5,06 | 0,49 | 0,11 | 0,00 | 6,81 | **17,46** |
| *17* | Pedetsi_1 | 1159700_1 | 1,26 | 10,31 | 10,28 | 92,00 | 4,08 | 0,00 | 0,00 | 1,01 | 14,63 | **122,00** |
| *18* | Peeli_1 | 1158100_1 | 0,58 | 10,37 | 8,16 | 34,64 | 4,90 | 0,00 | 1,76 | 0,11 | 6,67 | **56,24** |
| *19* | Peetri_1 | 1158700_1 | 0,41 | 10,37 | 5,95 | 29,29 | 1,52 | 0,57 | 0,57 | 0,00 | 1,48 | **39,38** |
| *20* | Pärlijõgi _1 | 1155700_1 | 0,99 | 10,37 | 11,32 | 60,94 | 1,69 | 3,93 | 3,63 | 0,04 | 14,12 | **95,67** |
| *21* | Pärlijõgi _2 | 1155700_2 | 0,64 | 10,36 | 12,49 | 34,40 | 0,92 | 0,00 | 0,00 | 0,00 | 13,47 | **61,28** |
| *22* | Rõngu_1 | 1021500_1 | 1,04 | 9,39 | 47,70 | 38,56 | 8,69 | 0,00 | 0,00 | 0,00 | 15,37 | **110,32** |
| *23* | Ujuste_1 | 1154300_1 | 0,53 | 10,33 | 17,16 | 21,90 | 6,77 | 0,00 | 0,00 | 0,32 | 5,23 | **51,38** |
| *24* | Vaidava_1 | 1158000_1 | 0,22 | 10,36 | 1,68 | 17,73 | 1,25 | 0,00 | 0,00 | 0,00 | 0,82 | **21,48** |
| *25* | Vaidava_2 | 1158000_2 | 0,14 | 10,36 | 4,30 | 6,22 | 2,50 | 0,00 | 0,00 | 0,00 | 0,02 | **13,04** |
| *26* | Vedame_1 | 1153300_1 | 0,15 | 12,18 | 1,03 | 10,16 | 0,00 | 0,00 | 0,00 | 0,00 | 1,22 | **12,41** |
| *27* | Õhne_1 | 1013700_1 | 0,23 | 4,86 | 1,06 | 39,37 | 0,30 | 3,14 | 3,14 | 0,00 | 0,00 | **47,01** |
| *28* | Õhne_2 | 1013700_2 | 1,11 | 6,29 | 32,59 | 110,90 | 4,93 | 2,51 | 4,76 | 0,00 | 20,25 | **175,94** |
| *29* | Õhne_3 | 1013700_3 | 0,99 | 12,35 | 25,79 | 38,56 | 4,21 | 1,43 | 0,77 | 0,00 | 9,02 | **79,78** |

***Table 2.*** *N diffused anthropogenic discharge of calculated river waterbodies*

| | **Object** | | **N diffused anthropogenic discharge, kg/a** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | N diffused anthrop., total |
| *1* | *2* | 3 | *4* | 5 | *6* | 7 | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 762,63 | 8,26 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **770,89** | |
| *2* | Hargla_1 | 1159300_1 | 3263,61 | 12,09 | 0,00 | 0,00 | 55,18 | 0,00 | 0,00 | **3330,88** | |
| *3* | Koiva_1 | 1154200_1 | 13615,83 | 49,22 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **13665,05** | |
| *4* | Kolga (1)_1 | 1081500_1 | 9703,31 | 31,42 | 0,00 | 0,00 | 75,12 | 0,00 | 0,00 | **9809,85** | |
| *5* | Kolga (2)_1 | 1120900_1 | 51297,16 | 136,81 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **51433,97** | |
| *6* | Kuura_1 | 1157600_1 | 12679,73 | 10,55 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **12690,28** | |
| *7* | Laanemetsa_1 | 1154600_1 | 21989,87 | 70,25 | 0,00 | 0,00 | 186,48 | 0,00 | 0,00 | **22246,60** | |
| *8* | Lilli_1 | 1153400_1 | 1770,13 | 106,07 | 0,00 | 0,00 | 48,38 | 0,00 | 0,00 | **1924,58** | |
| *9* | Mustjõgi_1 | 1154800_1 | 7863,30 | 12,32 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **7875,62** | |
| *10* | Mustjõgi_2 | 1154800_2 | 56148,13 | 61,64 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **56209,77** | |
| *11* | Mustjõgi_3 | 1154800_3 | 62535,88 | 24,86 | 0,00 | 0,00 | 111,96 | 0,00 | 0,00 | **62672,70** | |
| *12* | Mustjõgi_4 | 1154800_4 | 37263,24 | 56,28 | 0,00 | 0,00 | 255,32 | 0,00 | 0,00 | **37574,84** | |
| *13* | Mustjõgi_5 | 1154800_5 | 46903,01 | 39,47 | 0,00 | 0,00 | 21,51 | 0,00 | 0,00 | **46963,99** | |
| *14* | Pedeli_1 | 1012100_1 | 172,12 | 0,07 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **172,19** | |
| *15* | Pedeli_2 | 1012100_2 | 881,39 | 13,04 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **894,43** | |
| *16* | Pedeli_3 | 1012100_3 | 19623,59 | 30,26 | 0,00 | 0,00 | 11,15 | 0,00 | 0,00 | **19665,00** | |
| *17* | Pedetsi_1 | 1159700_1 | 29724,82 | 36,12 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **29760,94** | |
| *18* | Peeli_1 | 1158100_1 | 14398,47 | 43,16 | 0,00 | 0,00 | 203,78 | 0,00 | 0,00 | **14645,41** | |
| *19* | Peetri_1 | 1158700_1 | 10286,16 | 2,90 | 0,00 | 0,00 | 65,70 | 0,00 | 0,00 | **10354,76** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 19316,51 | 18,70 | 0,00 | 0,00 | 419,67 | 0,00 | 0,00 | **19754,88** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 21895,87 | 21,96 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **21917,83** | |
| *22* | Rõngu_1 | 1021500_1 | 77583,01 | 151,71 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **77734,72** | |
| *23* | Ujuste_1 | 1154300_1 | 50624,00 | 75,73 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **50699,73** | |
| *24* | Vaidava_1 | 1158000_1 | 2737,65 | 2,25 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **2739,90** | |
| *25* | Vaidava_2 | 1158000_2 | 6748,28 | 13,66 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **6761,94** | |
| *26* | Vedame_1 | 1153300_1 | 3010,40 | 225,60 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **3236,00** | |
| *27* | Õhne_1 | 1013700_1 | 767,51 | 40,21 | 0,00 | 0,00 | 170,35 | 0,00 | 0,00 | **978,07** | |
| *28* | Õhne_2 | 1013700_2 | 37509,29 | 234,97 | 0,00 | 0,00 | 289,68 | 0,00 | 0,00 | **38033,94** | |
| *29* | Õhne_2 | 1013700_3 | 54708,09 | 291,54 | 0,00 | 0,00 | 80,36 | 0,00 | 0,00 | **55079,99** | |

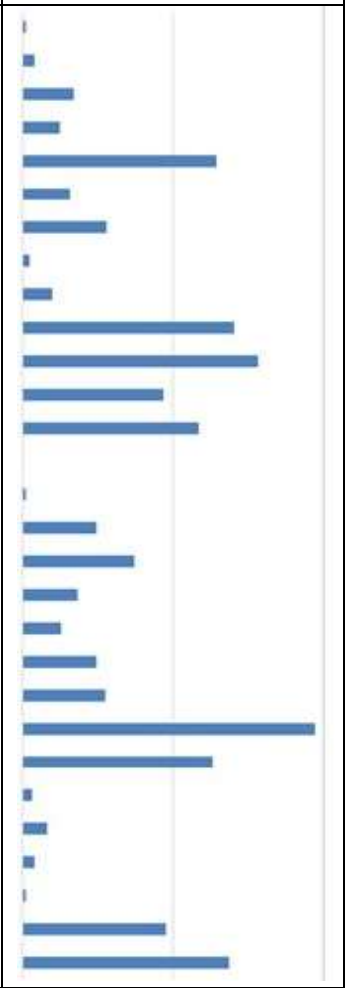

***Table 3.*** *N atmospheric discharge of calculated river waterbodies*

| | Object | | N atmospheric discharge, kg/a | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | N atmospheric, total |
| *1* | *2* | 3 | *4* | 5 | *6* | *7* | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 0,03 | 3,20 | 0,15 | 0,00 | 0,00 | 0,00 | 0,00 | **3,38** | |
| *2* | Hargla_1 | 1159300_1 | 0,37 | 8,90 | 0,32 | 0,09 | 0,09 | 171,63 | 0,16 | **181,56** | |
| *3* | Koiva_1 | 1154200_1 | 0,86 | 7,33 | 0,84 | 0,00 | 0,00 | 0,00 | 0,32 | **9,35** | |
| *4* | Kolga (1)_1 | 1081500_1 | 1,07 | 6,93 | 0,55 | 0,12 | 0,12 | 0,00 | 0,48 | **9,27** | |
| *5* | Kolga (2)_1 | 1120900_1 | 2,72 | 12,00 | 1,39 | 0,00 | 0,00 | 0,00 | 0,00 | **16,11** | |
| *6* | Kuura_1 | 1157600_1 | 1,39 | 9,39 | 0,32 | 0,05 | 0,00 | 0,00 | 1,87 | **13,02** | |
| *7* | Laanemetsa_1 | 1154600_1 | 1,39 | 8,77 | 1,07 | 0,00 | 0,18 | 48,79 | 0,56 | **60,76** | |
| *8* | Lilli_1 | 1153400_1 | 0,12 | 5,01 | 0,18 | 0,09 | 0,04 | 2,30 | 0,05 | **7,79** | |
| *9* | Mustjõgi_1 | 1154800_1 | 0,98 | 3,60 | 0,05 | 0,00 | 0,00 | 0,00 | 1,25 | **5,88** | |
| *10* | Mustjõgi_2 | 1154800_2 | 5,71 | 16,71 | 1,69 | 0,05 | 0,00 | 0,00 | 2,10 | **26,26** | |
| *11* | Mustjõgi_3 | 1154800_3 | 6,27 | 10,29 | 1,15 | 0,00 | 0,18 | 0,00 | 2,58 | **20,47** | |
| *12* | Mustjõgi_4 | 1154800_4 | 3,88 | 8,15 | 0,21 | 0,05 | 0,41 | 0,00 | 1,84 | **14,54** | |
| *13* | Mustjõgi_5 | 1154800_5 | 4,69 | 11,67 | 1,35 | 0,03 | 0,03 | 0,00 | 1,40 | **19,17** | |
| *14* | Pedeli_1 | 1012100_1 | 0,02 | 3,19 | 0,00 | 0,00 | 0,00 | 0,00 | 0,01 | **3,22** | |
| *15* | Pedeli_2 | 1012100_2 | 0,12 | 4,73 | 0,10 | 0,00 | 0,00 | 0,00 | 1,27 | **6,22** | |
| *16* | Pedeli_3 | 1012100_3 | 2,37 | 7,09 | 0,93 | 0,09 | 0,02 | 0,00 | 1,26 | **11,76** | |
| *17* | Pedetsi_1 | 1159700_1 | 1,90 | 17,00 | 0,75 | 0,00 | 0,00 | 442,59 | 2,70 | **464,94** | |
| *18* | Peeli_1 | 1158100_1 | 1,50 | 6,40 | 0,91 | 0,00 | 0,33 | 49,46 | 1,23 | **59,83** | |
| *19* | Peetri_1 | 1158700_1 | 1,10 | 5,41 | 0,28 | 0,10 | 0,10 | 0,00 | 0,27 | **7,26** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 2,10 | 11,26 | 0,31 | 0,73 | 0,67 | 17,82 | 2,61 | **35,50** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 2,31 | 6,36 | 0,17 | 0,00 | 0,00 | 0,00 | 2,49 | **11,33** | |
| *22* | Rõngu_1 | 1021500_1 | 8,81 | 7,13 | 1,61 | 0,00 | 0,00 | 0,64 | 2,84 | **21,03** | |
| *23* | Ujuste_1 | 1154300_1 | 3,16 | 4,04 | 1,25 | 0,00 | 0,00 | 142,26 | 0,97 | **151,68** | |
| *24* | Vaidava_1 | 1158000_1 | 0,32 | 3,28 | 0,23 | 0,00 | 0,00 | 0,15 | 0,15 | **4,13** | |
| *25* | Vaidava_2 | 1158000_2 | 0,79 | 1,15 | 0,46 | 0,00 | 0,00 | 0,00 | 0,00 | **2,40** | |
| *26* | Vedame_1 | 1153300_1 | 0,19 | 1,88 | 0,00 | 0,00 | 0,00 | 0,11 | 0,23 | **2,41** | |
| *27* | Õhne_1 | 1013700_1 | 0,19 | 7,28 | 0,06 | 0,58 | 0,58 | 0,00 | 0,00 | **8,69** | |
| *28* | Õhne_2 | 1013700_2 | 6,01 | 20,49 | 0,91 | 0,47 | 0,87 | 0,00 | 3,74 | **32,49** | |
| *29* | Õhne_2 | 1013700_3 | 4,78 | 7,13 | 0,77 | 0,26 | 0,14 | 0,00 | 1,66 | **14,74** | |

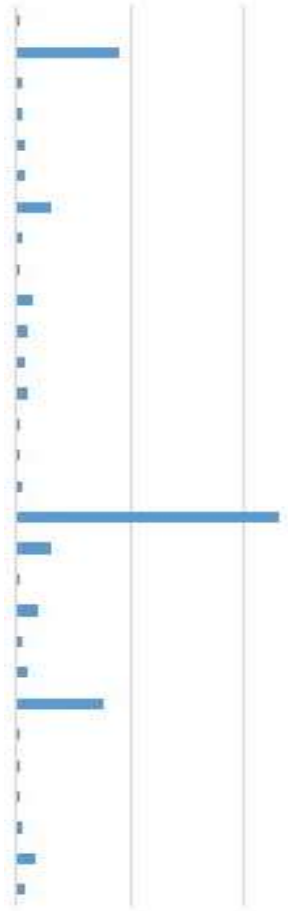

***Table 4.*** *N natural discharge of calculated river waterbodies*

| | Object | | N natural discharge, kg/a | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | Total | |
| *1* | *2* | 3 | *4* | 5 | *6* | 7 | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 123,26 | 8017,56 | 360,94 | 0,00 | 0,00 | 0,00 | 0,00 | **8501,76** | |
| *2* | Hargla_1 | 1159300_1 | 473,66 | 11430,70 | 407,43 | 113,17 | 113,17 | 0,00 | 211,05 | **12749,18** | |
| *3* | Koiva_1 | 1154200_1 | 1831,67 | 15639,20 | 1793,86 | 0,00 | 0,00 | 0,00 | 692,88 | **19957,61** | |
| *4* | Kolga (1)_1 | 1081500_1 | 1346,52 | 8717,44 | 691,35 | 154,07 | 154,07 | 0,00 | 600,84 | **11664,29** | |
| *5* | Kolga (2)_1 | 1120900_1 | 6857,35 | 30193,53 | 3490,04 | 0,00 | 0,00 | 0,00 | 0,00 | **40540,92** | |
| *6* | Kuura_1 | 1157600_1 | 1785,54 | 12059,14 | 416,91 | 62,46 | 0,00 | 0,00 | 2401,46 | **16725,51** | |
| *7* | Laanemetsa_1 | 1154600_1 | 2989,49 | 18713,44 | 2295,60 | 0,00 | 382,44 | 0,00 | 1191,17 | **25572,14** | |
| *8* | Lilli_1 | 1153400_1 | 282,34 | 12556,06 | 440,40 | 226,29 | 99,21 | 0,00 | 139,73 | **13744,03** | |
| *9* | Mustjõgi_1 | 1154800_1 | 1248,13 | 4624,73 | 66,16 | 0,00 | 0,00 | 0,00 | 1604,51 | **7543,53** | |
| *10* | Mustjõgi_2 | 1154800_2 | 7330,42 | 21456,33 | 2174,07 | 60,46 | 0,00 | 0,00 | 2698,62 | **33719,90** | |
| *11* | Mustjõgi_3 | 1154800_3 | 8057,21 | 13220,53 | 1478,11 | 0,00 | 229,62 | 0,00 | 3308,49 | **26293,96** | |
| *12* | Mustjõgi_4 | 1154800_4 | 4984,75 | 10461,37 | 271,64 | 67,90 | 523,62 | 0,00 | 2360,51 | **18669,79** | |
| *13* | Mustjõgi_5 | 1154800_5 | 6342,00 | 15897,41 | 1784,98 | 44,12 | 44,12 | 0,00 | 1969,99 | **26082,62** | |
| *14* | Pedeli_1 | 1012100_1 | 27,83 | 3521,93 | 0,00 | 0,00 | 0,00 | 0,00 | 12,81 | **3562,57** | |
| *15* | Pedeli_2 | 1012100_2 | 138,18 | 5226,98 | 115,52 | 0,00 | 0,00 | 0,00 | 1408,56 | **6889,24** | |
| *16* | Pedeli_3 | 1012100_3 | 2617,37 | 7829,51 | 1031,88 | 99,10 | 22,86 | 0,00 | 1389,26 | **12989,98** | |
| *17* | Pedetsi_1 | 1159700_1 | 4054,70 | 36225,57 | 1609,37 | 0,00 | 0,00 | 0,00 | 5725,27 | **47614,91** | |
| *18* | Peeli_1 | 1158100_1 | 1938,66 | 8221,20 | 1163,13 | 0,00 | 417,92 | 0,00 | 1582,40 | **13323,31** | |
| *19* | Peetri_1 | 1158700_1 | 1412,23 | 6951,34 | 361,81 | 134,73 | 134,73 | 0,00 | 352,02 | **9346,86** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 2685,13 | 14463,30 | 401,92 | 932,25 | 860,68 | 0,00 | 3350,91 | **22694,19** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 2963,09 | 8163,93 | 217,85 | 0,00 | 0,00 | 0,00 | 3196,31 | **14541,18** | |
| *22* | Rõngu_1 | 1021500_1 | 10251,49 | 8286,76 | 1866,87 | 0,00 | 0,00 | 0,00 | 3302,07 | **23707,19** | |
| *23* | Ujuste_1 | 1154300_1 | 6761,48 | 8637,31 | 2669,04 | 0,00 | 0,00 | 0,00 | 2041,04 | **20108,87** | |
| *24* | Vaidava_1 | 1158000_1 | 399,00 | 4206,94 | 295,86 | 0,00 | 0,00 | 0,00 | 194,47 | **5096,27** | |
| *25* | Vaidava_2 | 1158000_2 | 1019,45 | 1475,26 | 594,37 | 0,00 | 0,00 | 0,00 | 4,53 | **3093,61** | |
| *26* | Vedame_1 | 1153300_1 | 474,90 | 4724,26 | 0,00 | 0,00 | 0,00 | 0,00 | 568,48 | **5767,64** | |
| *27* | Õhne_1 | 1013700_1 | 117,76 | 4380,65 | 33,76 | 349,36 | 349,36 | 0,00 | 0,00 | **5230,89** | |
| *28* | Õhne_2 | 1013700_2 | 5062,30 | 14907,48 | 547,76 | 318,56 | 593,84 | 0,00 | 3926,57 | **25356,51** | |
| *29* | Õhne_2 | 1013700_3 | 7369,14 | 10857,50 | 1222,22 | 307,66 | 164,81 | 0,00 | 2638,26 | **22559,59** | |

***Table 5.*** *N diffused discharge (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | **Object** | | **N diffused discharge** (anthropogenic + atmospheric + natural), kg/a | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | *5* | 6 | *7* | *8* | 9 | *10* | *11* | *12* |
| *1* | Pedeli_1 | 1012100_1 | 199,97 | 3525,19 | 0,00 | 0,00 | 0,00 | 0,00 | 12,82 | **3737,98** | |
| *2* | Pedeli_2 | 1012100_2 | 1019,69 | 5244,75 | 115,62 | 0,00 | 0,00 | 0,00 | 1409,83 | **7789,89** | |
| *3* | Pedeli_3 | 1012100_3 | 22243,33 | 7866,86 | 1032,81 | 99,19 | 34,03 | 0,00 | 1390,52 | **32666,74** | |
| *4* | Õhne_1 | 1013700_1 | 885,46 | 4428,14 | 33,82 | 349,94 | 520,29 | 0,00 | 0,00 | **6217,65** | |
| *5* | Õhne_2 | 1013700_2 | 42577,60 | 15162,94 | 548,67 | 319,03 | 884,39 | 0,00 | 3930,31 | **63422,94** | |
| *6* | Õhne_3 | 1013700_3 | 62082,01 | 11156,17 | 1222,99 | 307,92 | 245,31 | 0,00 | 2639,92 | **77654,32** | |
| *7* | Rõngu_1 | 1021500_1 | 87843,31 | 8445,60 | 1868,48 | 0,00 | 0,00 | 0,64 | 3304,91 | **101462,94** | |
| *8* | Kolga (1)_1 | 1081500_1 | 11050,90 | 8755,79 | 691,90 | 154,19 | 229,31 | 0,00 | 601,32 | **21483,41** | |
| *9* | Kolga (2)_1 | 1120900_1 | 58157,23 | 30342,34 | 3491,43 | 0,00 | 0,00 | 0,00 | 0,00 | **91991,00** | |
| *10* | Vedame_1 | 1153300_1 | 3485,49 | 4951,74 | 0,00 | 0,00 | 0,00 | 0,11 | 568,71 | **9006,05** | |
| *11* | Lilli_1 | 1153400_1 | 2052,59 | 12667,14 | 440,58 | 226,38 | 147,63 | 2,30 | 139,78 | **15676,40** | |
| *12* | Atse_1 | 1154000_1 | 885,92 | 8029,02 | 361,09 | 0,00 | 0,00 | 0,00 | 0,00 | **9276,03** | |
| *13* | Koiva_1 | 1154200_1 | 15448,36 | 15695,75 | 1794,70 | 0,00 | 0,00 | 0,00 | 693,20 | **33632,01** | |
| *14* | Ujuste_1 | 1154300_1 | 57388,64 | 8717,08 | 2670,29 | 0,00 | 0,00 | 142,26 | 2042,01 | **70960,28** | |
| *15* | Laanemetsa_1 | 1154600_1 | 24980,75 | 18792,46 | 2296,67 | 0,00 | 569,10 | 48,79 | 1191,73 | **47879,50** | |
| *16* | Mustjõgi_1 | 1154800_1 | 9112,41 | 4640,65 | 66,21 | 0,00 | 0,00 | 0,00 | 1605,76 | **15425,03** | |
| *17* | Mustjõgi_2 | 1154800_2 | 63484,26 | 21534,68 | 2175,76 | 60,51 | 0,00 | 0,00 | 2700,72 | **89955,93** | |
| *18* | Mustjõgi_3 | 1154800_3 | 70599,36 | 13255,68 | 1479,26 | 0,00 | 341,76 | 0,00 | 3311,07 | **88987,13** | |
| *19* | Mustjõgi_4 | 1154800_4 | 42251,87 | 10525,80 | 271,85 | 67,95 | 779,35 | 0,00 | 2362,35 | **56259,17** | |
| *20* | Mustjõgi_5 | 1154800_5 | 53249,70 | 15948,55 | 1786,33 | 44,15 | 65,66 | 0,00 | 1971,39 | **73065,78** | |
| *21* | Pärlijõgi _1 | 1155700_1 | 22003,74 | 14493,26 | 402,23 | 932,98 | 1281,02 | 17,82 | 3353,52 | **42484,57** | |
| *22* | Pärlijõgi _2 | 1155700_2 | 24861,27 | 8192,25 | 218,02 | 0,00 | 0,00 | 0,00 | 3198,80 | **36470,34** | |
| *23* | Kuura_1 | 1157600_1 | 14466,66 | 12079,08 | 417,23 | 62,51 | 0,00 | 0,00 | 2403,33 | **29428,81** | |
| *24* | Vaidava_1 | 1158000_1 | 3136,97 | 4212,47 | 296,09 | 0,00 | 0,00 | 0,15 | 194,62 | **7840,30** | |
| *25* | Vaidava_2 | 1158000_2 | 7768,52 | 1490,07 | 594,83 | 0,00 | 0,00 | 0,00 | 4,53 | **9857,95** | |
| *26* | Peeli_1 | 1158100_1 | 16338,63 | 8270,76 | 1164,04 | 0,00 | 622,03 | 49,46 | 1583,63 | **28028,55** | |
| *27* | Peetri_1 | 1158700_1 | 11699,49 | 6959,65 | 362,09 | 134,83 | 200,53 | 0,00 | 352,29 | **19708,88** | |
| *28* | Hargla_1 | 1159300_1 | 3737,64 | 11451,69 | 407,75 | 113,26 | 168,44 | 171,63 | 211,21 | **16261,62** | |
| *29* | Pedetsi_1 | 1159700_1 | 33781,42 | 36278,69 | 1610,12 | 0,00 | 0,00 | 442,59 | 5727,97 | **77840,79** | |

***Table 6.*** *N diffused concentrations (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | **Object** | | **N diffused discharge concentration** (anthropogenic + atmospheric + natural), mg/l | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| *1* | Pedeli_1 | 1012100_1 | 5,082 | 0,727 | | | | | 0,760 | **0,762** | |
| *2* | Pedeli_2 | 1012100_2 | 5,335 | 0,729 | 0,722 | | | | 0,727 | **0,821** | |
| *3* | Pedeli_3 | 1012100_3 | 6,172 | 0,730 | 0,726 | 0,720 | 1,101 | | 0,726 | **1,826** | |
| *4* | Õhne_1 | 1013700_1 | 5,450 | 0,734 | 0,736 | 0,727 | 1,081 | | | **0,863** | |
| *5* | Õhne_2 | 1013700_2 | 6,582 | 0,689 | 0,561 | 0,640 | 0,936 | | 0,978 | **1,816** | |
| *6* | Õhne_2 | 1013700_3 | 6,180 | 0,743 | 0,746 | 0,553 | 0,818 | | 0,751 | **2,499** | |
| *7* | Rõngu_1 | 1021500_1 | 6,222 | 0,740 | 0,726 | | | | 0,726 | **3,107** | |
| *8* | Kolga (1)_1 | 1081500_1 | 5,965 | 0,729 | 0,727 | 0,729 | 1,084 | | 0,727 | **1,337** | |
| *9* | Kolga (2)_1 | 1120900_1 | 10,264 | 1,216 | 1,210 | | | | | **2,746** | |
| *10* | Vedame_1 | 1153300_1 | 8,810 | 1,269 | | | | | 1,214 | **1,889** | |
| *11* | Lilli_1 | 1153400_1 | 8,809 | 1,221 | 1,214 | 1,209 | 1,840 | 0,602 | 1,180 | **1,380** | |
| *12* | Atse_1 | 1154000_1 | 8,588 | 1,212 | 1,212 | | | | | **1,320** | |
| *13* | Koiva_1 | 1154200_1 | 10,194 | 1,215 | 1,210 | | | | 1,209 | **2,039** | |
| *14* | Ujuste_1 | 1154300_1 | 10,265 | 1,222 | 1,211 | | | 1,364 | 1,198 | **4,239** | |
| *15* | Laanemetsa_1 | 1154600_1 | 10,114 | 1,215 | 1,211 | | 1,801 | 1,361 | 1,211 | **2,262** | |
| *16* | Mustjõgi_1 | 1154800_1 | 5,300 | 0,728 | 0,723 | | | | 0,727 | **1,485** | |
| *17* | Mustjõgi_2 | 1154800_2 | 6,288 | 0,729 | 0,727 | 0,740 | | | 0,727 | **1,937** | |
| *18* | Mustjõgi_3 | 1154800_3 | 6,362 | 0,728 | 0,726 | | 1,078 | | 0,727 | **2,457** | |
| *19* | Mustjõgi_4 | 1154800_4 | 6,155 | 0,730 | 0,730 | 0,717 | 1,079 | | 0,726 | **2,188** | |
| *20* | Mustjõgi_5 | 1154800_5 | 6,414 | 0,773 | 0,751 | 0,711 | 1,058 | | 0,798 | **2,155** | |
| *21* | Pärlijõgi _1 | 1155700_1 | 5,947 | 0,728 | 0,728 | 0,726 | 1,080 | 1,363 | 0,727 | **1,359** | |
| *22* | Pärlijõgi _2 | 1155700_2 | 6,090 | 0,729 | 0,725 | | | | 0,727 | **1,821** | |
| *23* | Kuura_1 | 1157600_1 | 5,878 | 0,727 | 0,725 | 0,736 | | | 0,727 | **1,277** | |
| *24* | Vaidava_1 | 1158000_1 | 5,714 | 0,727 | 0,725 | | | | 0,726 | **1,117** | |
| *25* | Vaidava_2 | 1158000_2 | 5,529 | 0,733 | 0,728 | | | | 0,693 | **2,313** | |
| *26* | Peeli_1 | 1158100_1 | 6,124 | 0,730 | 0,727 | | 1,081 | 1,375 | 0,726 | **1,524** | |
| *27* | Peetri_1 | 1158700_1 | 6,014 | 0,727 | 0,729 | 0,724 | 1,076 | | 0,728 | **1,531** | |
| *28* | Hargla_1 | 1159300_1 | 5,719 | 0,728 | 0,725 | 0,722 | 1,074 | 1,347 | 0,726 | **0,919** | |
| *29* | Pedetsi_1 | 1159700_1 | 10,104 | 1,212 | 1,213 | | | 1,347 | 1,204 | **1,962** | |

***Table 7.*** *N diffused specific load (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | **Object** | | **N diffused specific load** (anthropogenic + atmospheric + natural), kg/a/km2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| 1 | Pedeli_1 | 1012100_1 | 1428 | 204 | | | | | 214 | 214 | |
| 2 | Pedeli_2 | 1012100_2 | 1500 | 205 | 203 | | | | 204 | 231 | |
| 3 | Pedeli_3 | 1012100_3 | 1735 | 205 | 204 | 202 | 309 | | 204 | 513 | |
| 4 | Õhne_1 | 1013700_1 | 835 | 112 | 113 | 111 | 166 | | | 132 | |
| 5 | Õhne_2 | 1013700_2 | 1306 | 137 | 111 | 127 | 186 | | 194 | 360 | |
| 6 | Õhne_3 | 1013700_3 | 2407 | 289 | 290 | 215 | 319 | | 293 | 973 | |
| 7 | Rõngu_1 | 1021500_1 | 1842 | 219 | 215 | | | | 215 | 920 | |
| 8 | Kolga (1)_1 | 1081500_1 | 1912 | 234 | 233 | 234 | 347 | | 233 | 429 | |
| 9 | Kolga (2)_1 | 1120900_1 | 3943 | 467 | 465 | | | | | 1055 | |
| 10 | Vedame_1 | 1153300_1 | 3384 | 487 | | | | | 466 | 726 | |
| 11 | Lilli_1 | 1153400_1 | 3365 | 466 | 464 | 462 | 703 | 230 | 451 | 527 | |
| 12 | Atse_1 | 1154000_1 | 3281 | 463 | 463 | | | | | 504 | |
| 13 | Koiva_1 | 1154200_1 | 3322 | 396 | 394 | | | | 394 | 665 | |
| 14 | Ujuste_1 | 1154300_1 | 3344 | 398 | 394 | | | 445 | 390 | 1381 | |
| 15 | Laanemetsa_1 | 1154600_1 | 3296 | 396 | 395 | | 587 | 444 | 395 | 737 | |
| 16 | Mustjõgi_1 | 1154800_1 | 1732 | 238 | 236 | | | | 238 | 485 | |
| 17 | Mustjõgi_2 | 1154800_2 | 2056 | 238 | 238 | 242 | | | 238 | 633 | |
| 18 | Mustjõgi_3 | 1154800_3 | 2080 | 238 | 237 | | 352 | | 238 | 803 | |
| 19 | Mustjõgi_4 | 1154800_4 | 2012 | 239 | 238 | 234 | 353 | | 237 | 715 | |
| 20 | Mustjõgi_5 | 1154800_5 | 2096 | 253 | 245 | 232 | 346 | | 261 | 704 | |
| 21 | Pärlijõgi _1 | 1155700_1 | 1944 | 238 | 238 | 237 | 353 | 446 | 238 | 444 | |
| 22 | Pärlijõgi _2 | 1155700_2 | 1990 | 238 | 237 | | | | 237 | 595 | |
| 23 | Kuura_1 | 1157600_1 | 1921 | 238 | 237 | 240 | | | 237 | 418 | |
| 24 | Vaidava_1 | 1158000_1 | 1867 | 238 | 237 | | | | 237 | 365 | |
| 25 | Vaidava_2 | 1158000_2 | 1807 | 240 | 238 | | | | 227 | 756 | |
| 26 | Peeli_1 | 1158100_1 | 2002 | 239 | 238 | | 353 | 450 | 237 | 498 | |
| 27 | Peetri_1 | 1158700_1 | 1966 | 238 | 238 | 237 | 352 | | 238 | 500 | |
| 28 | Hargla_1 | 1159300_1 | 1869 | 238 | 237 | 236 | 351 | 440 | 237 | 300 | |
| 29 | Pedetsi_1 | 1159700_1 | 3286 | 394 | 395 | | | 438 | 392 | 638 | |

***Table 8.*** *P diffused anthropogenic discharge of calculated river waterbodies*

| | **Object** | | **P diffused anthropogenic discharge, kg/a** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | 5 | *6* | 7 | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 18,78 | 0,73 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **19,51** | |
| *2* | Hargla_1 | 1159300_1 | 129,64 | 1,62 | 0,00 | 0,00 | 2,83 | 0,00 | 0,00 | **134,09** | |
| *3* | Koiva_1 | 1154200_1 | 372,43 | 4,36 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **376,79** | |
| *4* | Kolga (1)_1 | 1081500_1 | 858,82 | 9,15 | 0,00 | 0,00 | 8,37 | 0,00 | 0,00 | **876,34** | |
| *5* | Kolga (2)_1 | 1120900_1 | 1407,51 | 12,12 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **1419,63** | |
| *6* | Kuura_1 | 1157600_1 | 512,07 | 1,41 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **513,48** | |
| *7* | Laanemetsa_1 | 1154600_1 | 598,30 | 6,22 | 0,00 | 0,00 | 6,32 | 0,00 | 0,00 | **610,84** | |
| *8* | Lilli_1 | 1153400_1 | 43,92 | 9,39 | 0,00 | 0,00 | 1,64 | 0,00 | 0,00 | **54,95** | |
| *9* | Mustjõgi_1 | 1154800_1 | 295,92 | 1,65 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **297,57** | |
| *10* | Mustjõgi_2 | 1154800_2 | 2356,10 | 8,26 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **2364,36** | |
| *11* | Mustjõgi_3 | 1154800_3 | 2640,61 | 3,33 | 0,00 | 0,00 | 5,74 | 0,00 | 0,00 | **2649,68** | |
| *12* | Mustjõgi_4 | 1154800_4 | 1545,24 | 7,54 | 0,00 | 0,00 | 13,08 | 0,00 | 0,00 | **1565,86** | |
| *13* | Mustjõgi_5 | 1154800_5 | 1864,06 | 4,43 | 0,00 | 0,00 | 1,10 | 0,00 | 0,00 | **1869,59** | |
| *14* | Pedeli_1 | 1012100_1 | 4,24 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **4,24** | |
| *15* | Pedeli_2 | 1012100_2 | 22,11 | 1,16 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **23,27** | |
| *16* | Pedeli_3 | 1012100_3 | 539,04 | 2,68 | 0,00 | 0,00 | 0,38 | 0,00 | 0,00 | **542,10** | |
| *17* | Pedetsi_1 | 1159700_1 | 807,35 | 3,20 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **810,55** | |
| *18* | Peeli_1 | 1158100_1 | 595,15 | 5,78 | 0,00 | 0,00 | 10,44 | 0,00 | 0,00 | **611,37** | |
| *19* | Peetri_1 | 1158700_1 | 420,98 | 0,39 | 0,00 | 0,00 | 3,37 | 0,00 | 0,00 | **424,74** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 785,47 | 2,50 | 0,00 | 0,00 | 21,51 | 0,00 | 0,00 | **809,48** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 902,75 | 2,94 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **905,69** | |
| *22* | Rõngu_1 | 1021500_1 | 2140,91 | 13,44 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **2154,35** | |
| *23* | Ujuste_1 | 1154300_1 | 1389,65 | 6,71 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **1396,36** | |
| *24* | Vaidava_1 | 1158000_1 | 108,49 | 0,30 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **108,79** | |
| *25* | Vaidava_2 | 1158000_2 | 261,90 | 1,83 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **263,73** | |
| *26* | Vedame_1 | 1153300_1 | 75,24 | 19,99 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **95,23** | |
| *27* | Õhne_1 | 1013700_1 | 21,20 | 3,87 | 0,00 | 0,00 | 6,27 | 0,00 | 0,00 | **31,34** | |
| *28* | Õhne_2 | 1013700_2 | 1073,69 | 21,22 | 0,00 | 0,00 | 10,51 | 0,00 | 0,00 | **1105,42** | |
| *29* | Õhne_2 | 1013700_3 | 1495,41 | 25,84 | 0,00 | 0,00 | 2,72 | 0,00 | 0,00 | **1523,97** | |

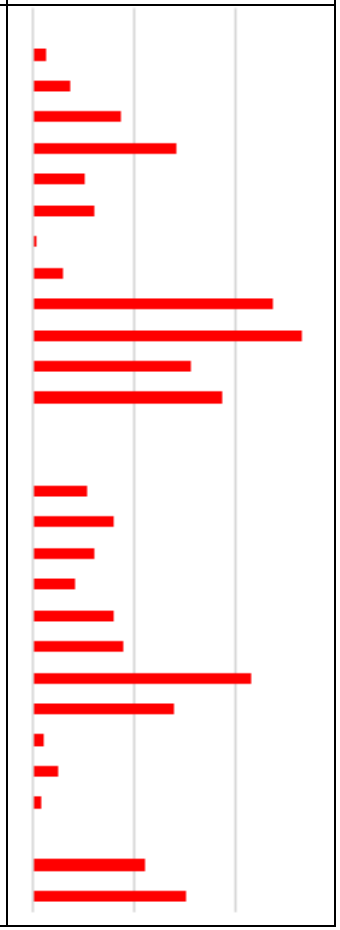

***Table 9.*** *P atmospheric discharge of calculated river waterbodies*

| | **Object** | | **P atmospheric discharge, kg/a** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | 5 | *6* | *7* | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 0,00 | 0,06 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **0,06** | |
| *2* | Hargla_1 | 1159300_1 | 0,00 | 0,16 | 0,01 | 0,00 | 0,00 | 3,16 | 0,00 | **3,33** | |
| *3* | Koiva_1 | 1154200_1 | 0,01 | 0,13 | 0,02 | 0,00 | 0,00 | 0,00 | 0,01 | **0,17** | |
| *4* | Kolga (1)_1 | 1081500_1 | 0,01 | 0,13 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | **0,16** | |
| *5* | Kolga (2)_1 | 1120900_1 | 0,05 | 0,22 | 0,03 | 0,00 | 0,00 | 0,00 | 0,00 | **0,30** | |
| *6* | Kuura_1 | 1157600_1 | 0,03 | 0,17 | 0,01 | 0,00 | 0,00 | 0,00 | 0,03 | **0,24** | |
| *7* | Laanemetsa_1 | 1154600_1 | 0,02 | 0,16 | 0,02 | 0,00 | 0,00 | 0,90 | 0,01 | **1,11** | |
| *8* | Lilli_1 | 1153400_1 | 0,00 | 0,09 | 0,00 | 0,00 | 0,00 | 0,04 | 0,00 | **0,13** | |
| *9* | Mustjõgi_1 | 1154800_1 | 0,01 | 0,07 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | **0,10** | |
| *10* | Mustjõgi_2 | 1154800_2 | 0,11 | 0,31 | 0,03 | 0,00 | 0,00 | 0,00 | 0,04 | **0,49** | |
| *11* | Mustjõgi_3 | 1154800_3 | 0,12 | 0,19 | 0,02 | 0,00 | 0,00 | 0,00 | 0,05 | **0,38** | |
| *12* | Mustjõgi_4 | 1154800_4 | 0,07 | 0,15 | 0,00 | 0,00 | 0,01 | 0,00 | 0,03 | **0,26** | |
| *13* | Mustjõgi_5 | 1154800_5 | 0,09 | 0,22 | 0,02 | 0,00 | 0,00 | 0,00 | 0,02 | **0,35** | |
| *14* | Pedeli_1 | 1012100_1 | 0,00 | 0,06 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **0,06** | |
| *15* | Pedeli_2 | 1012100_2 | 0,00 | 0,09 | 0,00 | 0,00 | 0,00 | 0,00 | 0,02 | **0,11** | |
| *16* | Pedeli_3 | 1012100_3 | 0,04 | 0,13 | 0,02 | 0,00 | 0,00 | 0,00 | 0,02 | **0,21** | |
| *17* | Pedetsi_1 | 1159700_1 | 0,03 | 0,31 | 0,01 | 0,00 | 0,00 | 8,15 | 0,05 | **8,55** | |
| *18* | Peeli_1 | 1158100_1 | 0,03 | 0,12 | 0,02 | 0,00 | 0,01 | 0,91 | 0,02 | **1,11** | |
| *19* | Peetri_1 | 1158700_1 | 0,02 | 0,10 | 0,01 | 0,00 | 0,00 | 0,00 | 0,01 | **0,14** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 0,03 | 0,21 | 0,01 | 0,01 | 0,01 | 0,33 | 0,05 | **0,65** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 0,04 | 0,12 | 0,00 | 0,00 | 0,00 | 0,00 | 0,05 | **0,21** | |
| *22* | Rõngu_1 | 1021500_1 | 0,16 | 0,13 | 0,03 | 0,00 | 0,00 | 0,01 | 0,05 | **0,38** | |
| *23* | Ujuste_1 | 1154300_1 | 0,06 | 0,07 | 0,02 | 0,00 | 0,00 | 2,62 | 0,02 | **2,79** | |
| *24* | Vaidava_1 | 1158000_1 | 0,00 | 0,06 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **0,06** | |
| *25* | Vaidava_2 | 1158000_2 | 0,02 | 0,02 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | **0,05** | |
| *26* | Vedame_1 | 1153300_1 | 0,00 | 0,03 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | **0,03** | |
| *27* | Õhne_1 | 1013700_1 | 0,00 | 0,13 | 0,00 | 0,01 | 0,01 | 0,00 | 0,00 | **0,15** | |
| *28* | Õhne_2 | 1013700_2 | 0,11 | 0,38 | 0,02 | 0,01 | 0,01 | 0,00 | 0,07 | **0,60** | |
| *29* | Õhne_2 | 1013700_3 | 0,08 | 0,13 | 0,01 | 0,00 | 0,00 | 0,00 | 0,03 | **0,25** | |

***Table 10.*** *P natural discharge of calculated river waterbodies*

| | Object | | P natural discharge, kg/a | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | 5 | *6* | *7* | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 4,07 | 265,04 | 11,93 | 0,00 | 0,00 | 0,00 | 0,00 | **281,04** | |
| *2* | Hargla_1 | 1159300_1 | 23,67 | 571,29 | 20,36 | 5,66 | 5,66 | 0,00 | 10,55 | **637,19** | |
| *3* | Koiva_1 | 1154200_1 | 60,55 | 517,00 | 59,30 | 0,00 | 0,00 | 0,00 | 22,91 | **659,76** | |
| *4* | Kolga (1)_1 | 1081500_1 | 92,74 | 600,37 | 47,61 | 10,61 | 10,61 | 0,00 | 41,38 | **803,32** | |
| *5* | Kolga (2)_1 | 1120900_1 | 226,69 | 998,13 | 115,37 | 0,00 | 0,00 | 0,00 | 0,00 | **1340,19** | |
| *6* | Kuura_1 | 1157600_1 | 89,24 | 602,69 | 20,84 | 3,12 | 0,00 | 0,00 | 120,02 | **835,91** | |
| *7* | Laanemetsa_1 | 1154600_1 | 98,83 | 618,63 | 75,88 | 0,00 | 12,64 | 0,00 | 39,38 | **845,36** | |
| *8* | Lilli_1 | 1153400_1 | 9,34 | 415,08 | 14,56 | 7,48 | 3,28 | 0,00 | 4,62 | **454,36** | |
| *9* | Mustjõgi_1 | 1154800_1 | 62,38 | 231,14 | 3,31 | 0,00 | 0,00 | 0,00 | 80,19 | **377,02** | |
| *10* | Mustjõgi_2 | 1154800_2 | 366,37 | 1072,35 | 108,66 | 3,02 | 0,00 | 0,00 | 134,87 | **1685,27** | |
| *11* | Mustjõgi_3 | 1154800_3 | 402,69 | 660,74 | 73,87 | 0,00 | 11,48 | 0,00 | 165,35 | **1314,13** | |
| *12* | Mustjõgi_4 | 1154800_4 | 249,12 | 522,84 | 13,58 | 3,39 | 26,17 | 0,00 | 117,97 | **933,07** | |
| *13* | Mustjõgi_5 | 1154800_5 | 303,68 | 755,81 | 86,78 | 2,21 | 2,21 | 0,00 | 90,93 | **1241,62** | |
| *14* | Pedeli_1 | 1012100_1 | 0,93 | 116,42 | 0,00 | 0,00 | 0,00 | 0,00 | 0,42 | **117,77** | |
| *15* | Pedeli_2 | 1012100_2 | 4,57 | 172,79 | 3,82 | 0,00 | 0,00 | 0,00 | 46,57 | **227,75** | |
| *16* | Pedeli_3 | 1012100_3 | 86,53 | 258,83 | 34,11 | 3,28 | 0,76 | 0,00 | 45,93 | **429,44** | |
| *17* | Pedetsi_1 | 1159700_1 | 134,04 | 1197,54 | 53,20 | 0,00 | 0,00 | 0,00 | 189,27 | **1574,05** | |
| *18* | Peeli_1 | 1158100_1 | 96,90 | 410,88 | 58,13 | 0,00 | 20,89 | 0,00 | 79,09 | **665,89** | |
| *19* | Peetri_1 | 1158700_1 | 70,58 | 347,42 | 18,08 | 6,73 | 6,73 | 0,00 | 17,59 | **467,13** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 134,20 | 722,85 | 20,09 | 46,59 | 43,02 | 0,00 | 167,47 | **1134,22** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 148,09 | 408,02 | 10,89 | 0,00 | 0,00 | 0,00 | 159,75 | **726,75** | |
| *22* | Rõngu_1 | 1021500_1 | 338,89 | 273,94 | 61,71 | 0,00 | 0,00 | 0,00 | 109,16 | **783,70** | |
| *23* | Ujuste_1 | 1154300_1 | 223,52 | 285,52 | 88,23 | 0,00 | 0,00 | 0,00 | 67,47 | **664,74** | |
| *24* | Vaidava_1 | 1158000_1 | 19,94 | 210,26 | 14,79 | 0,00 | 0,00 | 0,00 | 9,72 | **254,71** | |
| *25* | Vaidava_2 | 1158000_2 | 50,95 | 73,73 | 29,71 | 0,00 | 0,00 | 0,00 | 0,23 | **154,62** | |
| *26* | Vedame_1 | 1153300_1 | 15,70 | 156,17 | 0,00 | 0,00 | 0,00 | 0,00 | 18,79 | **190,66** | |
| *27* | Õhne_1 | 1013700_1 | 4,23 | 157,24 | 1,21 | 12,54 | 12,54 | 0,00 | 0,00 | **187,76** | |
| *28* | Õhne_2 | 1013700_2 | 175,21 | 523,46 | 19,66 | 11,26 | 21,02 | 0,00 | 133,41 | **884,02** | |
| *29* | Õhne_2 | 1013700_3 | 243,60 | 358,93 | 40,40 | 10,17 | 5,45 | 0,00 | 87,22 | **745,77** | |

***Table 11.*** *P diffused discharge (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | Object | | P diffused discharge (anthropogenic + atmospheric + natural), kg/a | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | 5 | *6* | *7* | *8* | 9 | *10* | 11 | *12* |
| *1* | Atse_1 | 1154000_1 | 22,85 | 265,83 | 11,93 | 0,00 | 0,00 | 0,00 | 0,00 | **300,61** | |
| *2* | Hargla_1 | 1159300_1 | 153,31 | 573,07 | 20,37 | 5,66 | 8,49 | 3,16 | 10,55 | **774,61** | |
| *3* | Koiva_1 | 1154200_1 | 432,99 | 521,49 | 59,32 | 0,00 | 0,00 | 0,00 | 22,92 | **1036,72** | |
| *4* | Kolga (1)_1 | 1081500_1 | 951,57 | 609,65 | 47,62 | 10,61 | 18,98 | 0,00 | 41,39 | **1679,82** | |
| *5* | Kolga (2)_1 | 1120900_1 | 1634,25 | 1010,47 | 115,40 | 0,00 | 0,00 | 0,00 | 0,00 | **2760,12** | |
| *6* | Kuura_1 | 1157600_1 | 601,34 | 604,27 | 20,85 | 3,12 | 0,00 | 0,00 | 120,05 | **1349,63** | |
| *7* | Laanemetsa_1 | 1154600_1 | 697,15 | 625,01 | 75,90 | 0,00 | 18,96 | 0,90 | 39,39 | **1457,31** | |
| *8* | Lilli_1 | 1153400_1 | 53,26 | 424,56 | 14,56 | 7,48 | 4,92 | 0,04 | 4,62 | **509,44** | |
| *9* | Mustjõgi_1 | 1154800_1 | 358,31 | 232,86 | 3,31 | 0,00 | 0,00 | 0,00 | 80,21 | **674,69** | |
| *10* | Mustjõgi_2 | 1154800_2 | 2722,58 | 1080,92 | 108,69 | 3,02 | 0,00 | 0,00 | 134,91 | **4050,12** | |
| *11* | Mustjõgi_3 | 1154800_3 | 3043,42 | 664,26 | 73,89 | 0,00 | 17,22 | 0,00 | 165,40 | **3964,19** | |
| *12* | Mustjõgi_4 | 1154800_4 | 1794,43 | 530,53 | 13,58 | 3,39 | 39,26 | 0,00 | 118,00 | **2499,19** | |
| *13* | Mustjõgi_5 | 1154800_5 | 2167,83 | 760,46 | 86,80 | 2,21 | 3,31 | 0,00 | 90,95 | **3111,56** | |
| *14* | Pedeli_1 | 1012100_1 | 5,17 | 116,48 | 0,00 | 0,00 | 0,00 | 0,00 | 0,42 | **122,07** | |
| *15* | Pedeli_2 | 1012100_2 | 26,68 | 174,04 | 3,82 | 0,00 | 0,00 | 0,00 | 46,59 | **251,13** | |
| *16* | Pedeli_3 | 1012100_3 | 625,61 | 261,64 | 34,13 | 3,28 | 1,14 | 0,00 | 45,95 | **971,75** | |
| *17* | Pedetsi_1 | 1159700_1 | 941,42 | 1201,05 | 53,21 | 0,00 | 0,00 | 8,15 | 189,32 | **2393,15** | |
| *18* | Peeli_1 | 1158100_1 | 692,08 | 416,78 | 58,15 | 0,00 | 31,34 | 0,91 | 79,11 | **1278,37** | |
| *19* | Peetri_1 | 1158700_1 | 491,58 | 347,91 | 18,09 | 6,73 | 10,10 | 0,00 | 17,60 | **892,01** | |
| *20* | Pärlijõgi _1 | 1155700_1 | 919,70 | 725,56 | 20,10 | 46,60 | 64,54 | 0,33 | 167,52 | **1944,35** | |
| *21* | Pärlijõgi _2 | 1155700_2 | 1050,88 | 411,08 | 10,89 | 0,00 | 0,00 | 0,00 | 159,80 | **1632,65** | |
| *22* | Rõngu_1 | 1021500_1 | 2479,96 | 287,51 | 61,74 | 0,00 | 0,00 | 0,01 | 109,21 | **2938,43** | |
| *23* | Ujuste_1 | 1154300_1 | 1613,23 | 292,30 | 88,25 | 0,00 | 0,00 | 2,62 | 67,49 | **2063,89** | |
| *24* | Vaidava_1 | 1158000_1 | 128,43 | 210,62 | 14,79 | 0,00 | 0,00 | 0,00 | 9,72 | **363,56** | |
| *25* | Vaidava_2 | 1158000_2 | 312,87 | 75,58 | 29,72 | 0,00 | 0,00 | 0,00 | 0,23 | **418,40** | |
| *26* | Vedame_1 | 1153300_1 | 90,94 | 176,19 | 0,00 | 0,00 | 0,00 | 0,00 | 18,79 | **285,92** | |
| *27* | Õhne_1 | 1013700_1 | 25,43 | 161,24 | 1,21 | 12,55 | 18,82 | 0,00 | 0,00 | **219,25** | |
| *28* | Õhne_2 | 1013700_2 | 1249,01 | 545,06 | 19,68 | 11,27 | 31,54 | 0,00 | 133,48 | **1990,04** | |
| *29* | Õhne_2 | 1013700_3 | 1739,09 | 384,90 | 40,41 | 10,17 | 8,17 | 0,00 | 87,25 | **2269,99** | |

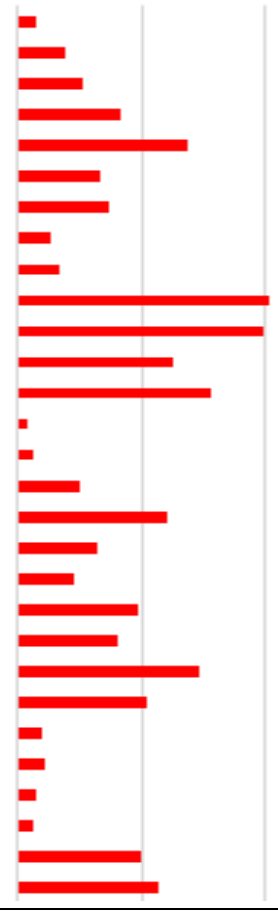

***Table 12.*** *P diffused concentrations (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | **Object** | | **P diffused discharge concentration** (anthropogenic + atmospheric + natural), mg/l | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | 3 | *4* | *5* | 6 | *7* | *8* | 9 | *10* | *11* | 12 |
| *1* | Pedeli_1 | 1012100_1 | 0,131 | 0,024 | | | | | 0,025 | **0,025** | |
| *2* | Pedeli_2 | 1012100_2 | 0,140 | 0,024 | 0,024 | | | | 0,024 | **0,026** | |
| *3* | Pedeli_3 | 1012100_3 | 0,174 | 0,024 | 0,024 | 0,024 | 0,037 | | 0,024 | **0,054** | |
| *4* | Õhne_1 | 1013700_1 | 0,157 | 0,027 | 0,026 | 0,026 | 0,039 | | | **0,030** | |
| *5* | Õhne_2 | 1013700_2 | 0,193 | 0,025 | 0,020 | 0,023 | 0,033 | | 0,033 | **0,057** | |
| *6* | Õhne_3 | 1013700_3 | 0,173 | 0,026 | 0,025 | 0,018 | 0,027 | | 0,025 | **0,073** | |
| *7* | Rõngu_1 | 1021500_1 | 0,176 | 0,025 | 0,024 | | | | 0,024 | **0,090** | |
| *8* | Kolga (1)_1 | 1081500_1 | 0,514 | 0,051 | 0,050 | 0,050 | 0,090 | | 0,050 | **0,105** | |
| *9* | Kolga (2)_1 | 1120900_1 | 0,288 | 0,040 | 0,040 | | | | | **0,082** | |
| *10* | Vedame_1 | 1153300_1 | 0,230 | 0,045 | | | | | 0,040 | **0,060** | |
| *11* | Lilli_1 | 1153400_1 | 0,229 | 0,041 | 0,040 | 0,040 | 0,061 | 0,010 | 0,039 | **0,045** | |
| *12* | Atse_1 | 1154000_1 | 0,222 | 0,040 | 0,040 | | | | | **0,043** | |
| *13* | Koiva_1 | 1154200_1 | 0,286 | 0,040 | 0,040 | | | | 0,040 | **0,063** | |
| *14* | Ujuste_1 | 1154300_1 | 0,289 | 0,041 | 0,040 | | | 0,025 | 0,040 | **0,123** | |
| *15* | Laanemetsa_1 | 1154600_1 | 0,282 | 0,040 | 0,040 | | 0,060 | 0,025 | 0,040 | **0,069** | |
| *16* | Mustjõgi_1 | 1154800_1 | 0,208 | 0,037 | 0,036 | | | | 0,036 | **0,065** | |
| *17* | Mustjõgi_2 | 1154800_2 | 0,270 | 0,037 | 0,036 | 0,037 | | | 0,036 | **0,087** | |
| *18* | Mustjõgi_3 | 1154800_3 | 0,274 | 0,036 | 0,036 | | 0,054 | | 0,036 | **0,109** | |
| *19* | Mustjõgi_4 | 1154800_4 | 0,261 | 0,037 | 0,036 | 0,036 | 0,054 | | 0,036 | **0,097** | |
| *20* | Mustjõgi_5 | 1154800_5 | 0,261 | 0,037 | 0,036 | 0,036 | 0,053 | | 0,037 | **0,092** | |
| *21* | Pärlijõgi _1 | 1155700_1 | 0,249 | 0,036 | 0,036 | 0,036 | 0,054 | 0,025 | 0,036 | **0,062** | |
| *22* | Pärlijõgi _2 | 1155700_2 | 0,257 | 0,037 | 0,036 | | | | 0,036 | **0,082** | |
| *23* | Kuura_1 | 1157600_1 | 0,244 | 0,036 | 0,036 | 0,037 | | | 0,036 | **0,059** | |
| *24* | Vaidava_1 | 1158000_1 | 0,234 | 0,036 | 0,036 | | | | 0,036 | **0,052** | |
| *25* | Vaidava_2 | 1158000_2 | 0,223 | 0,037 | 0,036 | | | | 0,035 | **0,098** | |
| *26* | Peeli_1 | 1158100_1 | 0,259 | 0,037 | 0,036 | | 0,054 | 0,025 | 0,036 | **0,070** | |
| *27* | Peetri_1 | 1158700_1 | 0,253 | 0,036 | 0,036 | 0,036 | 0,054 | | 0,036 | **0,069** | |
| *28* | Hargla_1 | 1159300_1 | 0,235 | 0,036 | 0,036 | 0,036 | 0,054 | 0,025 | 0,036 | **0,044** | |
| *29* | Pedetsi_1 | 1159700_1 | 0,282 | 0,040 | 0,040 | | | 0,025 | 0,040 | **0,060** | |

***Table 13.*** *P diffused specific load (anthropogenic + atmospheric + natural) of calculated river waterbodies*

| | **Object** | | **P diffused specific load** (anthropogenic + atmospheric + natural), kg/a/km2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Catchment | Code | Arable | Forest | Pasture | Swamps | Peatland | Water | Other | **Total** | |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| 1 | Pedeli_1 | 1012100_1 | 36,93 | 6,75 | | | | | 7,00 | 6,99 | |
| 2 | Pedeli_2 | 1012100_2 | 39,24 | 6,80 | 6,70 | | | | 6,75 | 7,44 | |
| 3 | Pedeli_3 | 1012100_3 | 48,80 | 6,82 | 6,75 | 6,69 | 10,36 | | 6,75 | 15,27 | |
| 4 | Õhne_1 | 1013700_1 | 23,99 | 4,10 | 4,03 | 4,00 | 5,99 | | | 4,66 | |
| 5 | Õhne_2 | 1013700_2 | 38,32 | 4,91 | 3,99 | 4,49 | 6,63 | | 6,59 | 11,31 | |
| 6 | Õhne_3 | 1013700_3 | 67,43 | 9,98 | 9,60 | 7,11 | 10,61 | | 9,67 | 28,45 | |
| 7 | Rõngu_1 | 1021500_1 | 51,99 | 7,46 | 7,10 | | | | 7,11 | 26,64 | |
| 8 | Kolga (1)_1 | 1081500_1 | 164,63 | 16,27 | 16,03 | 16,08 | 28,76 | | 16,04 | 33,51 | |
| 9 | Kolga (2)_1 | 1120900_1 | 110,80 | 15,56 | 15,37 | | | | | 31,65 | |
| 10 | Vedame_1 | 1153300_1 | 88,29 | 17,34 | | | | | 15,40 | 23,04 | |
| 11 | Lilli_1 | 1153400_1 | 87,31 | 15,63 | 15,33 | 15,27 | 23,43 | 4,00 | 14,90 | 17,13 | |
| 12 | Atse_1 | 1154000_1 | 84,63 | 15,33 | 15,29 | | | | | 16,35 | |
| 13 | Koiva_1 | 1154200_1 | 93,12 | 13,15 | 13,04 | | | | 13,02 | 20,48 | |
| 14 | Ujuste_1 | 1154300_1 | 94,01 | 13,35 | 13,04 | | | 8,19 | 12,90 | 40,17 | |
| 15 | Laanemetsa_1 | 1154600_1 | 91,97 | 13,17 | 13,04 | | 19,55 | 8,18 | 13,04 | 22,43 | |
| 16 | Mustjõgi_1 | 1154800_1 | 68,12 | 11,95 | 11,82 | | | | 11,87 | 21,22 | |
| 17 | Mustjõgi_2 | 1154800_2 | 88,17 | 11,96 | 11,87 | 12,08 | | | 11,87 | 28,51 | |
| 18 | Mustjõgi_3 | 1154800_3 | 89,64 | 11,92 | 11,86 | | 17,75 | | 11,87 | 35,78 | |
| 19 | Mustjõgi_4 | 1154800_4 | 85,45 | 12,04 | 11,91 | 11,69 | 17,76 | | 11,86 | 31,77 | |
| 20 | Mustjõgi_5 | 1154800_5 | 85,31 | 12,04 | 11,92 | 11,63 | 17,42 | | 12,03 | 29,98 | |
| 21 | Pärlijõgi _1 | 1155700_1 | 81,25 | 11,91 | 11,89 | 11,86 | 17,78 | 8,25 | 11,86 | 20,32 | |
| 22 | Pärlijõgi _2 | 1155700_2 | 84,14 | 11,95 | 11,84 | | | | 11,86 | 26,64 | |
| 23 | Kuura_1 | 1157600_1 | 79,86 | 11,89 | 11,85 | 12,00 | | | 11,86 | 19,15 | |
| 24 | Vaidava_1 | 1158000_1 | 76,45 | 11,88 | 11,83 | | | | 11,85 | 16,93 | |
| 25 | Vaidava_2 | 1158000_2 | 72,76 | 12,15 | 11,89 | | | | 11,50 | 32,09 | |
| 26 | Peeli_1 | 1158100_1 | 84,81 | 12,03 | 11,87 | | 17,81 | 8,27 | 11,86 | 22,73 | |
| 27 | Peetri_1 | 1158700_1 | 82,62 | 11,88 | 11,90 | 11,81 | 17,72 | | 11,89 | 22,65 | |
| 28 | Hargla_1 | 1159300_1 | 76,66 | 11,90 | 11,84 | 11,79 | 17,69 | 8,10 | 11,85 | 14,31 | |
| 29 | Pedetsi_1 | 1159700_1 | 91,58 | 13,05 | 13,04 | | | 8,07 | 12,94 | 19,62 | |

***Table 14.*** *Comparison of N-tot concentrations with standards in EE and LV*

| Object | | P-tot | Estonian status | | Latvian status classes by river type (T1-T6) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Name | Code | mg/l | Class | Limits | T1 | T2 | T3 | T4 | T5 | T6 |
| Pedeli_3 | 1012100_3 | 0,762 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Pedeli_2 | 1012100_2 | 0,821 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Õhne_1 | 1013700_1 | 0,863 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Hargla_1 | 1159300_1 | 0,920 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Vaidava_1 | 1158000_1 | 1,117 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Kuura_1 | 1157600_1 | 1,278 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Atse_1 | 1154000_1 | 1,320 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Kolga (1)_1 | 1081500_1 | 1,358 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Pärlijõgi _1 | 1155700_1 | 1,359 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Lilli_1 | 1153400_1 | 1,380 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Mustjõgi_1 | 1154800_1 | 1,485 | High | <1,5 | <1,5 | <1,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Peeli_1 | 1158100_1 | 1,524 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Peetri_1 | 1158700_1 | 1,531 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | <1,8 | <2,0 | <1,8 | <1,8 |
| Pärlijõgi _2 | 1155700_2 | 1,832 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | 1,8-2,3 | <2,0 | 1,8-2,8 | 1,8-2,8 |
| Vedame_1 | 1153300_1 | 1,889 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | 1,8-2,3 | <2,0 | 1,8-2,8 | 1,8-2,8 |
| Õhne_2 | 1013700_2 | 1,923 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | 1,8-2,3 | <2,0 | 1,8-2,8 | 1,8-2,8 |
| Mustjõgi_2 | 1154800_2 | 1,937 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | 1,8-2,3 | <2,0 | 1,8-2,8 | 1,8-2,8 |
| Pedetsi_1 | 1159700_1 | 1,963 | Good | 1,5–3,0 | 1,5–2,0 | 1,5–2,5 | 1,8-2,3 | <2,0 | 1,8-2,8 | 1,8-2,8 |
| Pedeli_1 | 1012100_1 | 2,011 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 1,8-2,3 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Koiva_1 | 1154200_1 | 2,039 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 1,8-2,3 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Mustjõgi_3 | 1154800_3 | 2,156 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 1,8-2,3 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Mustjõgi_5 | 1154800_5 | 2,190 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 1,8-2,3 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Laanemetsa_1 | 1154600_1 | 2,262 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 1,8-2,3 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Vaidava_2 | 1158000_2 | 2,313 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 2,3-2,8 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Mustjõgi_4 | 1154800_4 | 2,457 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 2,3-2,8 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Õhne_3 | 1013700_3 | 2,500 | Good | 1,5–3,0 | 2,0–2,5 | 1,5–2,5 | 2,3-2,8 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Kolga (2)_1 | 1120900_1 | 2,747 | Good | 1,5–3,0 | 2,5-3,0 | 2,5-3,5 | 2,3-2,8 | 2,0-3,0 | 1,8-2,8 | 1,8-2,8 |
| Rõngu_1 | 1021500_1 | 3,111 | derate | >3,0–6,0 | >3,0 | 2,5-3,5 | 2,8-3,3 | 3,0-4,0 | 2,8-3,8 | 2,8-3,8 |
| Ujuste_1 | 1154300_1 | 4,239 | derate | >3,0–6,0 | >3,0 | 3,5-4,5 | >3,3 | 4,0-5,0 | 3,8-4,8 | 3,8-4,8 |

***Table 15.*** *Comparison of P-tot concentrations with standards in EE and LV*

| Object | | P-tot | Estonian status | | Latvian status classes by river type (T1-T6) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Name | Code | mg/l | Class | Limits | T1 | T2 | T3 | T4 | T5 | T6 |
| Pedeli_1 | 1012100_1 | 0,025 | High | <0,05 | <0,04 | <0,045 | <0,05 | <0,06 | <0,04 | <0,045 |
| Pedeli_2 | 1012100_2 | 0,026 | High | <0,05 | <0,04 | <0,045 | <0,05 | <0,06 | <0,04 | <0,045 |
| Õhne_1 | 1013700_1 | 0,030 | High | <0,05 | <0,04 | <0,045 | <0,05 | <0,06 | <0,04 | <0,045 |
| Atse_1 | 1154000_1 | 0,043 | High | <0,05 | 0,04-0,065 | <0,045 | <0,05 | <0,06 | 0,04-0,065 | <0,045 |
| Hargla_1 | 1159300_1 | 0,044 | High | <0,05 | 0,04-0,065 | <0,045 | <0,05 | <0,06 | 0,04-0,065 | <0,045 |
| Lilli_1 | 1153400_1 | 0,045 | High | <0,05 | 0,04-0,065 | <0,045 | <0,05 | <0,06 | 0,04-0,065 | <0,045 |
| Vaidava_1 | 1158000_1 | 0,052 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | <0,06 | 0,04-0,065 | 0,045-0,09 |
| Kuura_1 | 1157600_1 | 0,059 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | <0,06 | 0,04-0,065 | 0,045-0,09 |
| Õhne_2 | 1013700_2 | 0,059 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | <0,06 | 0,04-0,065 | 0,045-0,09 |
| Vedame_1 | 1153300_1 | 0,060 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | <0,06 | 0,04-0,065 | 0,045-0,09 |
| Pedetsi_1 | 1159700_1 | 0,061 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,04-0,065 | 0,045-0,09 |
| Pärlijõgi _1 | 1155700_1 | 0,062 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,04-0,065 | 0,045-0,09 |
| Koiva_1 | 1154200_1 | 0,063 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,04-0,065 | 0,045-0,09 |
| Mustjõgi_1 | 1154800_1 | 0,065 | Good | 0,05–0,08 | 0,04-0,065 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,04-0,065 | 0,045-0,09 |
| Pedeli_3 | 1012100_3 | 0,068 | Good | 0,05–0,08 | 0,065-0,09 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| nemetsa_1 | 1154600_1 | 0,069 | Good | 0,05–0,08 | 0,065-0,09 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Peetri_1 | 1158700_1 | 0,069 | Good | 0,05–0,08 | 0,065-0,09 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Peeli_1 | 1158100_1 | 0,070 | Good | 0,05–0,08 | 0,065-0,09 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Õhne_3 | 1013700_3 | 0,073 | Good | 0,05–0,08 | 0,065-0,09 | 0,045-0,09 | 0,05-0,075 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Kolga (2)_1 | 1120900_1 | 0,082 | Moderate | >0,08–0,1 | 0,065-0,09 | 0,045-0,09 | 0,075-0,10 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Pärlijõgi _2 | 1155700_2 | 0,083 | Moderate | >0,08–0,1 | 0,065-0,09 | 0,045-0,09 | 0,075-0,10 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Mustjõgi_2 | 1154800_2 | 0,087 | Moderate | >0,08–0,1 | 0,065-0,09 | 0,045-0,09 | 0,075-0,10 | 0,06-0,09 | 0,065-0,09 | 0,045-0,09 |
| Rõngu_1 | 1021500_1 | 0,090 | Moderate | >0,08–0,1 | 0,065-0,09 | 0,09-0,135 | 0,075-0,10 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Mustjõgi_5 | 1154800_5 | 0,092 | Moderate | >0,08–0,1 | 0,09-0,115 | 0,09-0,135 | 0,075-0,10 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Mustjõgi_4 | 1154800_4 | 0,097 | Moderate | >0,08–0,1 | 0,09-0,115 | 0,09-0,135 | 0,075-0,10 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Vaidava_2 | 1158000_2 | 0,098 | Moderate | >0,08–0,1 | 0,09-0,115 | 0,09-0,135 | 0,075-0,10 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Kolga (1)_1 | 1081500_1 | 0,105 | Poor | >0,1–0,12 | 0,09-0,115 | 0,09-0,135 | 0,10-0,125 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Mustjõgi_3 | 1154800_3 | 0,109 | Poor | >0,1–0,12 | 0,09-0,115 | 0,09-0,135 | 0,10-0,125 | 0,09-0,135 | 0,09-0,115 | 0,09-0,135 |
| Ujuste_1 | 1154300_1 | 0,123 | Bad | >0,12 | >0,115 | 0,09-0,135 | 0,10-0,125 | 0,09-0,135 | >0,115 | 0,09-0,135 |

***Table 16.*** *Potential actionable diffuse source loads for nitrogen*

| OBJECT | | Existing status in catchment outlet | | Load reduction to achieve N "High" status | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Catchment outlet | | | | Catchment source | | | |
| | | | | N_tot | N_tot | N_dif | **N_dif needed reduction** | N_tot | N_tot | N_dif | **N_dif needed reduction** |
| Catchment | Code | mg/l | class | *mg/l* | *kg/a* | *kg/a* | *kg/a* | *kg/a* | *kg/a* | *kg/a* | *kg/a* |
| Pedeli_3 | 1012100_3 | 0,762 | High | 1,500 | 7360,6 | 7360,6 | -3623 | 1,659 | 8140,1 | 8140,1 | -4006 |
| Pedeli_2 | 1012100_2 | 0,821 | High | 1,500 | 14233 | 14233 | -6443 | 1,659 | 15741 | 15741 | -7126 |
| Õhne_1 | 1013700_1 | 0,863 | High | 1,500 | 10808 | 10808 | -4590 | 1,725 | 12429 | 12429 | -5278 |
| Hargla_1 | 1159300_1 | 0,920 | High | 1,500 | 26533 | 26528 | -10267 | 1,903 | 33656 | 33651 | -13023 |
| Vaidava_1 | 1158000_1 | 1,117 | High | 1,500 | 10530 | 10530 | -2689 | 1,647 | 11565 | 11565 | -2954 |
| Kuura_1 | 1157600_1 | 1,278 | High | 1,500 | 34557 | 34548 | -5119 | 1,644 | 37870 | 37858 | -5610 |
| Atse_1 | 1154000_1 | 1,320 | High | 1,500 | 10539 | 10539 | -1263 | 1,629 | 11445 | 11445 | -1372 |
| Kolga (1)_1 | 1081500_1 | 1,358 | High | 1,500 | 24100 | 23766 | -2283 | 1,645 | 26428 | 26074 | -2505 |
| Pärlijõgi _1 | 1155700_1 | 1,359 | High | 1,500 | 46909 | 46909 | -4424 | 1,718 | 53734 | 53734 | -5068 |
| Lilli_1 | 1153400_1 | 1,380 | High | 1,500 | 17041 | 17041 | -1365 | 1,663 | 18894 | 18894 | -1513 |
| Mustjõgi_1 | 1154800_1 | 1,485 | High | 1,500 | 15586 | 15586 | -160,8 | 1,644 | 17079 | 17079 | -176,2 |
| Peeli_1 | 1158100_1 | 1,524 | Good | 1,500 | 27583 | 27583 | 445,92 | 1,828 | 33620 | 33620 | 543,53 |
| Peetri_1 | 1158700_1 | 1,531 | Good | 1,500 | 19312 | 19312 | 397,17 | 1,644 | 21162 | 21162 | 435,22 |
| Pärlijõgi _2 | 1155700_2 | 1,832 | Good | 1,500 | 30044 | 29812 | 6658,4 | 1,647 | 32997 | 32668 | 7296,3 |
| Vedame_1 | 1153300_1 | 1,889 | Good | 1,500 | 7150,1 | 7150,1 | 1855,9 | 1,633 | 7782,9 | 7782,9 | 2020,2 |
| Õhne_2 | 1013700_2 | 1,923 | Good | 1,500 | 52385 | 48646 | 14777 | 1,687 | 58923 | 54568 | 16576 |
| Mustjõgi_2 | 1154800_2 | 1,937 | Good | 1,500 | 69669 | 69669 | 20287 | 1,644 | 76344 | 76344 | 22230 |
| Pedetsi_1 | 1159700_1 | 1,963 | Good | 1,500 | 59519 | 59457 | 18384 | 1,907 | 75669 | 75581 | 23369 |
| Pedeli_1 | 1012100_1 | 2,011 | Good | 1,500 | 26839 | 23528 | 9138,9 | 1,677 | 30004 | 26019 | 10107 |
| Koiva_1 | 1154200_1 | 2,039 | Good | 1,500 | 24741 | 24737 | 8895,4 | 1,644 | 27117 | 27111 | 9749,4 |
| Mustjõgi_3 | 1154800_3 | 2,156 | Good | 1,500 | 50863 | 50823 | 22243 | 1,644 | 55743 | 55693 | 24375 |
| Mustjõgi_5 | 1154800_5 | 2,190 | Good | 1,500 | 38574 | 38518 | 17742 | 1,644 | 42273 | 42208 | 19441 |
| Laanemetsa_1 | 1154600_1 | 2,262 | Good | 1,500 | 31755 | 31755 | 16124 | 1,816 | 38444 | 38444 | 19520 |
| Vaidava_2 | 1158000_2 | 2,313 | Good | 1,500 | 6391,7 | 6391,7 | 3466,2 | 1,644 | 7004,1 | 7004,1 | 3798,3 |
| Mustjõgi_4 | 1154800_4 | 2,457 | Good | 1,500 | 54326 | 54320 | 34667 | 1,644 | 59532 | 59524 | 37988 |
| Õhne_3 | 1013700_3 | 2,500 | Good | 1,500 | 46611 | 46578 | 31077 | 1,626 | 50521 | 50487 | 33685 |
| Kolga (2)_1 | 1120900_1 | 2,747 | Good | 1,500 | 50257 | 50217 | 41774 | 1,629 | 54573 | 54516 | 45349 |
| Rõngu_1 | 1021500_1 | 3,111 | Moderate | 1,500 | 48982 | 48865 | 52598 | 1,658 | 54139 | 53971 | 58095 |
| Ujuste_1 | 1154300_1 | 4,239 | Moderate | 1,500 | 25110 | 25110 | 45850 | 1,895 | 31728 | 31728 | 57933 |

***Table 17.*** *Potential actionable diffuse source loads for phosphorus*

| OBJECT | | Existing status in catchment outlet | | Load reduction to achieve P "High" status | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Catchment outlet | | | | Catchment source | | | |
| | | | | P_tot | P_tot | P_dif | **P_dif needed reduction** | P_tot | P_tot | P_dif | **P_dif needed reduction** |
| Catchment | Code | *mg/l* | *class* | *mg/l* | *kg/a* | *kg/a* | *kg/a* | *mg/l* | *kg/a* | *kg/a* | *kg/a* |
| Pedeli_1 | 1012100_1 | 0,025 | High | 0,050 | 245 | 245 | -123 | 0,054 | 265 | 265 | -133 |
| Pedeli_2 | 1012100_2 | 0,026 | High | 0,050 | 474 | 474 | -223 | 0,054 | 512 | 512 | -241 |
| Õhne_1 | 1013700_1 | 0,030 | High | 0,050 | 360 | 360 | -141 | 0,056 | 403 | 403 | -158 |
| Atse_1 | 1154000_1 | 0,043 | High | 0,050 | 351 | 351 | -51 | 0,053 | 374 | 374 | -54 |
| Hargla_1 | 1159300_1 | 0,044 | High | 0,050 | 884 | 884 | -109 | 0,063 | 1110 | 1109 | -137 |
| Lilli_1 | 1153400_1 | 0,045 | High | 0,050 | 568 | 568 | -59 | 0,054 | 615 | 615 | -63 |
| Vaidava_1 | 1158000_1 | 0,052 | Good | 0,050 | 351 | 351 | 13 | 0,054 | 377 | 377 | 13 |
| Kuura_1 | 1157600_1 | 0,059 | Good | 0,050 | 1152 | 1151 | 199 | 0,054 | 1235 | 1233 | 213 |
| Õhne_2 | 1013700_2 | 0,059 | Good | 0,050 | 1746 | 1672 | 320 | 0,055 | 1920 | 1834 | 349 |
| Vedame_1 | 1153300_1 | 0,060 | Good | 0,050 | 238 | 238 | 48 | 0,053 | 254 | 254 | 51 |
| Pedetsi_1 | 1159700_1 | 0,061 | Good | 0,050 | 1984 | 1974 | 420 | 0,063 | 2499 | 2485 | 528 |
| Pärlijõgi _1 | 1155700_1 | 0,062 | Good | 0,050 | 1564 | 1564 | 381 | 0,056 | 1745 | 1745 | 425 |
| Koiva_1 | 1154200_1 | 0,063 | Good | 0,050 | 825 | 824 | 212 | 0,054 | 884 | 883 | 228 |
| Mustjõgi_1 | 1154800_1 | 0,065 | Good | 0,050 | 520 | 520 | 155 | 0,054 | 557 | 557 | 166 |
| Pedeli_3 | 1012100_3 | 0,068 | Good | 0,050 | 895 | 660 | 320 | 0,056 | 995 | 713 | 337 |
| Laanemetsa_1 | 1154600_1 | 0,069 | Good | 0,050 | 1059 | 1059 | 399 | 0,059 | 1253 | 1253 | 472 |
| Peetri_1 | 1158700_1 | 0,069 | Good | 0,050 | 644 | 644 | 248 | 0,054 | 690 | 690 | 266 |
| Peeli_1 | 1158100_1 | 0,070 | Good | 0,050 | 919 | 919 | 359 | 0,060 | 1097 | 1097 | 428 |
| Õhne_3 | 1013700_3 | 0,073 | Good | 0,050 | 1554 | 1544 | 726 | 0,053 | 1649 | 1640 | 771 |
| Kolga (2)_1 | 1120900_1 | 0,082 | Moderate | 0,050 | 1675 | 1674 | 1087 | 0,053 | 1781 | 1779 | 1155 |
| Pärlijõgi _2 | 1155700_2 | 0,083 | Moderate | 0,050 | 1001 | 977 | 656 | 0,054 | 1082 | 1047 | 702 |
| Mustjõgi_2 | 1154800_2 | 0,087 | Moderate | 0,050 | 2322 | 2322 | 1728 | 0,054 | 2488 | 2488 | 1851 |
| Rõngu_1 | 1021500_1 | 0,090 | Moderate | 0,050 | 1633 | 1627 | 1312 | 0,054 | 1763 | 1755 | 1415 |
| Mustjõgi_5 | 1154800_5 | 0,092 | Moderate | 0,050 | 1695 | 1689 | 1422 | 0,054 | 1818 | 1809 | 1525 |
| Mustjõgi_4 | 1154800_4 | 0,097 | Moderate | 0,050 | 1286 | 1279 | 1221 | 0,054 | 1378 | 1370 | 1308 |
| Vaidava_2 | 1158000_2 | 0,098 | Moderate | 0,050 | 213 | 213 | 205 | 0,054 | 228 | 228 | 220 |
| Kolga (1)_1 | 1081500_1 | 0,105 | Poor | 0,050 | 803 | 799 | 881 | 0,054 | 862 | 857 | 945 |
| Mustjõgi_3 | 1154800_3 | 0,109 | Poor | 0,050 | 1811 | 1810 | 2154 | 0,054 | 1940 | 1939 | 2308 |
| Ujuste_1 | 1154300_1 | 0,123 | Bad | 0,050 | 837 | 837 | 1227 | 0,062 | 1045 | 1045 | 1532 |

# Comments and conclusions

*EstModel* has been used to calculate N, P loads and concentrations in 29 waterbodies in the Koiva river basin. The calculated waterbodies differed from each other in terms of surface area, specific flow rate and types of land cover (Table xxx.1). Calculations were based on 2017 data. The advantage of the *EstModel* is that the model results express the discharge solely from the catchment area. It means that the loads are estimated without impactct of catchment upstream flow and so the model allows analysis impacts only within the catchment area. The main conclusions that can be drawn from the present results are as follows:

1) Source data for the model were obtained automatically from Estonian national databases. The model was automatically installed based on the contours of the water catchment areas. (Figure 1 and Figure 3).
2) The model calculates runoff of nutrients separately from each Corine land cover class of a calculated area and from point sources. The model distinguishes natural and man-made load (see Figure 4).
3) Simplifications used in the model:
    a. stationarity (constant calculation conditions in the area);
    b. homogeneity (similarity of the calculation parameters of the subcatchment).
4) Based on nitrogen content, most of the waterbodies (27) were in high or good status, two waterbodies were in moderate status class (Figure 5 and Table 14). In the case of phosphorus, 6 waterbodies were in high status class, 12 in good, 7 in moderate, 4 in poor and 1 in bad status class (Figure 5 and Table 15).
5) It is obvious that nutrient concentrations are dependent on the human activity. Model results confirm this strong dependence for nitrogen (Figure 6 ) and for phosphorus (Figure 7). These figures also show that the calculated natural concentrations of nitrogen and phosphorus are not constant. The natural concentration of nitrogen ranged from 0.73 to 1.21 mgN / l and the phosphorus from 0.024 to 0.050 mgP / l.
6) The relationship between N and P concentrations was significant, with higher concentrations of N the concentration of P is also higher (Figure 8). In contrast, there was no remarkable dependence of N and P concentrations on the runoff (Figure 9).
7) The dependence of the N and P retention on the size of the catchment area was weak (Figure 10) since the model assumes that retention is occurring mainly along the river. Therefore, it can be assumed that the modelled retention is slightly underestimated. In the case of phosphorus, the retention was between 6 and 21% and in the case of nitrogen between 8 and 21% (Appendix 1).
8) The N / P ratio varied in the range of 13 to 35 (Figure 11), indicating that phosphorus was a limiting element for plants vegetation in all waterbodies.

9) The calculated part of natural load in the total load varied within very large range - in case of N from 5 to 77% (Figure 12) and in case of P from 4 to 73% (Figure 13).
10) In Estonia, the same status class boundaries have been used for different river types, Latvia has different limit values for different river types. In general view, the boundaries of the Estonian and Latvian status classes coincide well. Division of waterbodies into status classes yielded a fairly similar result for both countries methodology (Table 16 and Table 17).
11) Nitrogen concentrations ranged from 0,76 to 4,27 mg / l (Table 14) and phosphorus concentrations ranged from 0,025 to 0,123 mg / l (Table 15). N, P concentrations were strongly related to the proportion of anthropogenic load in the total load (Appendix 1).
12) The modelled natural concentrations varied in case of N from 0,72 mg/l to 1,21 mg/l and in case of P from 0,024 mg/l to 0,050 mg/l (Appendix 1).
13) Specific diffused load of calculated river waterbodies varied in case of N from 132 kg/a/km$^2$ to 1382 kg/a/km$^2$ (Table 6) and in case of P from 7 kg/a/km$^2$ to 40 kg/a/ km$^2$ (Table 13).
14) The model indicated that significantly higher concentrations were from agricultural land, whereas in other areas the proportion of natural concentration in the total concentration was predominant (Table 6 and Table 12).
15) In all waterbodies, the share of point source loads in the total load was small and the diffuse load was predominant (Appendix 1).
16) Potential actionable loads (the amounts that may be removed by the measures) have been calculated for all waterbodies. It is also found the amouts of load that should be eliminated to provide a certain status class (Table 16 and Table 17).
17) Modelling work showed three bottleneck topics that need to be clarified for the better planning of mitigation measures. They are:
    a. the effectiveness of the measures requires clarification – it is needed to find a quantitative relationship between the implementation of measures and results of measures;
    b. the diffuse pollution retention needs to be better understood;
    c. the calculation of the anthropogenic load is based on our not good knowledge of the natural load and therefore the accuracy of calculated human load depends on the quite hypothetical value of the natural concentrations.

# Literature

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